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Tennessee Valley Authority

Draft Environmental Impact Statement

Red Hills Power Project

February 1998

PROPOSED PURCHASE OF ELECTRICITY GENERATED BY THE RED HILLS POWER PROJECT

Responsible Federal Agency: Tennessee Valley Authority (TVA)

Cooperating Federal Agency: U.S. Army Corps of Engineers (COE)

Abstract: TVA proposes to purchase 440 megawatts (MW) of electrical energy from the Red Hills Power Project (RHPP). This energy would be provided from a proposed 440-MW (approximate capacity) lignite-fueled generation facility (Red Hills Generation Facility) and a proposed surface lignite mine (Red Hills Lignite Mine) located near the Town of Ackerman in Choctaw County, Mississippi. Choctaw Generation, Inc., proposes to build the generation facility and Mississippi Lignite Mining Company proposes to operate the lignite mine.

TVA and the COE cooperated in preparing this Environmental Impact Statement (EIS). The purpose of this EIS is to evaluate the environmental impacts of the proposed TVA purchase of electricity generated by the Red Hills Power Project (RHPP) and the COE permitting of wetlands and waters of the U.S. for the project.

The RHPP would consist of a surface lignite mine and a lignite-fueled generation facility near the Town of Ackerman in Choctaw County, Mississippi. Associated project components include water supply and disposal systems, a natural gas supply pipeline, and transmission line connections. Choctaw County and the state of Mississippi also propose to develop the Red Hills EcoPlex industrial park adjacent to the proposed generation facility. Although the EcoPlex is not part of the actions under consideration by TVA and the COE, potential cumulative impacts resulting from development of the EcoPlex are assessed.

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ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standards
ADM	Average Daily Membership
ADT	Average Daily Traffic
agl	Above Ground Level
amsl	Above Mean Sea Level
ANSI	American National Standards Institute
AQRV	Air-Quality—Related Value
ARPA	Archaeological Resources Protection Act
A/RR	Agricultural/Residential Rural
BACT	Best Available Control Technology
bgl	Below Ground Level
bls	Below Land Surface
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand
C & G	Columbus and Greenville
CAA	Clean Air Act
$CaCO_3$	Calcium Carbonate
CASTNet	Clean Air Status and Trends Network
CEC	Cation Exchange Capacity
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act, 1980
CFB	Circulating Fluidized Bed
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
CGI	Choctaw Generation, Inc.
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COE	U.S. Army Corps of Engineers
COS	Carbonyl Sulfide
CT	Combustion Turbine
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
DO	Dissolved Oxygen
EC	Electrical Conductivity
EDAW	EDAW, Inc.
EIS	Environmental Impact Statement
EMA	Eutaw-McShan Aquifer
EMF	Electric and Magnetic Fields
EMS	Emergency Medical Services
EMT	Emergency Medical Training
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ERC	TVA's Environmental Research Center
ESA	Endangered Species Act
F^-	Fluorides

FAA .... Federal Aviation Administration
FEIS .... Final Environmental Impact Statement
FEMA .... Federal Emergency Management Agency
FERC .... Federal Energy Regulatory Commission
FHWA .... Federal Highway Administration
FONSI .... Finding Of No Significant Impact
FR .... Federal Register
FWS .... U.S. Fish and Wildlife Service
FY .... Fiscal Year
GCM .... Global Climate Model
GHG .... Greenhouse Gas
H_2S .... Hydrogen Sulfide
H_2SO_4 .... Sulfuric Acid
HNO_3 .... Nitric Acid
HAP .... Hazardous Air Pollutant
Horizon .... Horizon Environmental Services, Inc.
HUD .... U.S. Department of Housing and Urban Development
IRP .... TVA's Integrated Resource Plan
L_D .... Equivalent Day Sound Level
L_{DN} .... Equivalent Day-Night Sound Level
L_{eq} .... Equivalent Sound Level
$L_{eq(1)}$ .... Equivalent Sound Level for a 1-hour Period
$L_{eq(24)}$ .... Equivalent Sound Level for a 24-hour Period
LHV .... Lower Heating Value
LMA .... Labor Market Area
L_{max} .... Maximum Level (of Noise)
L_N .... Equivalent Night Sound Level
LWA .... Lower Wilcox Aquifer
M-1 .... Code for Industrial Land Use
MCL .... Maximum Contaminant Level
MDECD .... Mississippi Department of Economic and Community Development
MDEQ .... Mississippi Department of Environmental Quality
MDOT .... Mississippi Department of Transportation
MIR .... Maximum Individual Risk
MLMC .... Mississippi Lignite Mining Company
MOLWR .... Mississippi Office of Land and Water Resources
MOPC .... Mississippi Office of Pollution Control
MOU .... Memorandum of Understanding
MP .... Malcolm Pirnie, Inc.
MSA .... Metropolitan Statistical Area
MSHA .... Mine Safety and Health Administration
msl .... Mean Sea Level
MSU .... Mississippi State University
MUWA .... Meridian-Upper Wilcox Aquifer
MWA .... Middle Wilcox Aquifer
N_2O .... Nitrous Oxide
NAAQS .... National Ambient Air Quality Standards
NAC .... The North American Coal Corporation
NADP .... National Atmospheric Deposition Program
$NaHCO_3$ .... Sodium Bicarbonate

NAS .... National Audubon Society
NCRP .... National Council on Radiation Protection
NDDN .... National Dry Deposition Network
NEHRP .... National Earthquake Hazard Reduction Program
NEMA .... NEMA Corporation, Inc.
NEPA .... National Environmental Policy Act
NESHAPS .... National Emission Standard for Hazardous Air Pollutants
NH_3 .... Ammonia
NHPA .... National Historic Preservation Act
NIOSH .... National Institute for Occupational Safety and Health
NNWR .... Noxubee National Wildlife Refuge
NO .... Nitrogen Oxide
NO_2 .... Nitrogen Dioxide
NO_3 .... Nitrogen Trioxide
NOA .... Notice of Availability
NOI .... Notice of Intent
NOx .... Nitrogen Oxides
NOy .... NOx + HNO_3 + PAN + NO_3 + organic nitrates
NPDES .... National Pollutant Discharge Elimination System
NPS .... National Park Service
NRCS .... Natural Resources Conservation Service
NSPS .... New Source Performance Standards
NSR .... New Source Review
NTU .... Nephelometric Turbidity Units
NWA .... National Wilderness Area
NWI .... National Wetlands Inventory
NWS .... National Weather Service
O_3 .... Ozone
OSHA .... Occupational Safety and Health Administration
PAH .... Polynuclear Aromatic Hydrocarbon
PAN .... Peroxyacetylnitrate
Parkway .... Natchez Trace Parkway
PC .... Pulverized Coal
PCB .... Polychlorinated Biphenyls
PCC .... Phillips Coal Company
PEL .... Permissible Exposure Limit
PhM .... Phosphate Mining
PHX .... Primary Heat Exchanger
PM .... Particulate Matter
PM_{10} .... Particulate Matter less than or equal to 10 micrometers in diameter
$PM_{2.5}$ .... Particulate Matter less than or equal to 2.5 micrometers in diameter
POM .... Polycyclic Organic Matter
PPA .... Pollution Prevention Act
PPP .... Pollution Prevention Plan
PSD .... Prevention of Significant Deterioration
Pt-Co .... Platinum Cobalt
PVC .... Polyvinyl Chloride
R-1 .... Code for Residential Land Use
Ra .... Radium
RCRA .... Resource Conservation and Recovery Act

REIS .... Regional Economic Information System
RHGF .... Red Hills Generation Facility
RHLM .... Red Hills Lignite Mine
RHPP .... Red Hills Power Project
RMS .... Root Mean Square
RO .... Reverse Osmosis
ROD .... Record of Decision
ROW .... Right-of-Way
RWHA .... Ron W. Harden and Associates
SAR .... Sodium Adsorption Ratio
SARA .... Superfund Amendments and Reauthorization Act
SCION .... Southeast Consortium Intermediate Ozone Network
SCS .... Soil Conservation Service
SD .... Standard Deviation
SEL .... Sound Exposure Level
SF-1M .... Single Family-Mixed
SGLP .... Synthetic Groundwater Leaching Procedure
SHPO .... State Historic Preservation Officer
SIA .... Significant Impact Areas
SIC .... Standard Industrial Classification
SMSA .... Standard Metropolitan Statistical Area
SO_2 .... Sulfur Dioxide
SO_3 .... Sulfur Trioxide
SOS .... Southern Oxidants Study
SO_X .... Sulfur Oxides
SPCC .... Spill Prevention Control and Countermeasure Plan
SPLP .... Synthetic Precipitation Leaching Procedure
SPT .... Standard Penetration Test
SR .... State Road
ST .... Steam Turbine
SU .... Standard Units, measurement for pH
TAS .... Tuscaloosa Aquifer System
TCLP .... Toxicity Characteristic Leaching Procedure
TDS .... Total Dissolved Solids
TN .... Total Nitrogen
TP .... Total Phosphorus
TPI .... Tractebel Power, Inc.
TSP .... Total Suspended Particulates
TSS .... Total Suspended Solids
TVA .... Tennessee Valley Authority
US .... United States
USDA .... U.S. Department of Agriculture
USDC .... U.S. Department of Commerce
USGS .... U.S. Geological Survey
VMT .... Vehicle Miles Traveled
VOC .... Volatile Organic Compound
WET .... Wetland Evaluation Technique
WQ .... Water Quality
WUCA .... Water Use Caution Area
WUP .... Water Use Permit

UNITS OF MEASURE

°C	Degrees Celsius
°F	Degrees Fahrenheit
%	Percent
μg	Microgram(s)
μg/g	Micrograms Per Gram
μg/kg	Micrograms Per Kilogram
μg/L	Micrograms Per Liter
$\mu g/m^2/yr$	Micrograms Per Square Meter Per Year
$\mu g/m^3$	Micrograms Per Cubic Meter
μm	Micrometer(s) or Micron(s)
μmhos/cm	Micromhos per centimeter, a measure of electrical conductivity
ac-ft	Acre-Feet
bbl	Barrel
Btu	British Thermal Unit(s)
Btu/gal	British Thermal Units Per Gallon
Btu/hr	British Thermal Units Per Hour
Btu/lb	British Thermal Units Per Pound
cfs	Cubic Feet Per Second
cm/sec	Centimeters Per Second
Col/100 ml	Colonies Per 100 Milliliter (coliform unit)
CSM	Cubic Feet Per Second Per Square Mile
dB	Decibel(s)
dBA	Decibel(s), A-weighted
ft	Foot or Feet
ft^2	Square Feet
ft/day	Feet Per Day
ft/ft	Feet Per Foot
ft-msl	Feet Above Mean Sea Level
ft^2/day	Square Feet Per Day
ft^3/day	Cubic Feet Per Day
$ft^3/day/ft^3$	Cubic Feet Per Day Per Cubic Foot
ft^3/hr	Cubic Feet Per Hour
g	Gram(s)
g/cm^3	Grams Per Cubic Centimeter
g/m^2	Grams Per Square Meter
$g/m^2/yr$	Grams Per Square Meter Per Year
g/sec	Grams Per Second
gal	gallon
GJ	Gigajoule(s)
gpd	Gallons Per Day
gpm	Gallons Per Minute
gpm/ft	Gallons Per Minute Per Foot
gpm/ft^2	Gallons Per Minute Per Square Foot
Hz	Hertz (cycles per second)
in.	Inch(es)
kg	Kilogram(s)
kg/km^2	Kilograms Per Square Kilometer

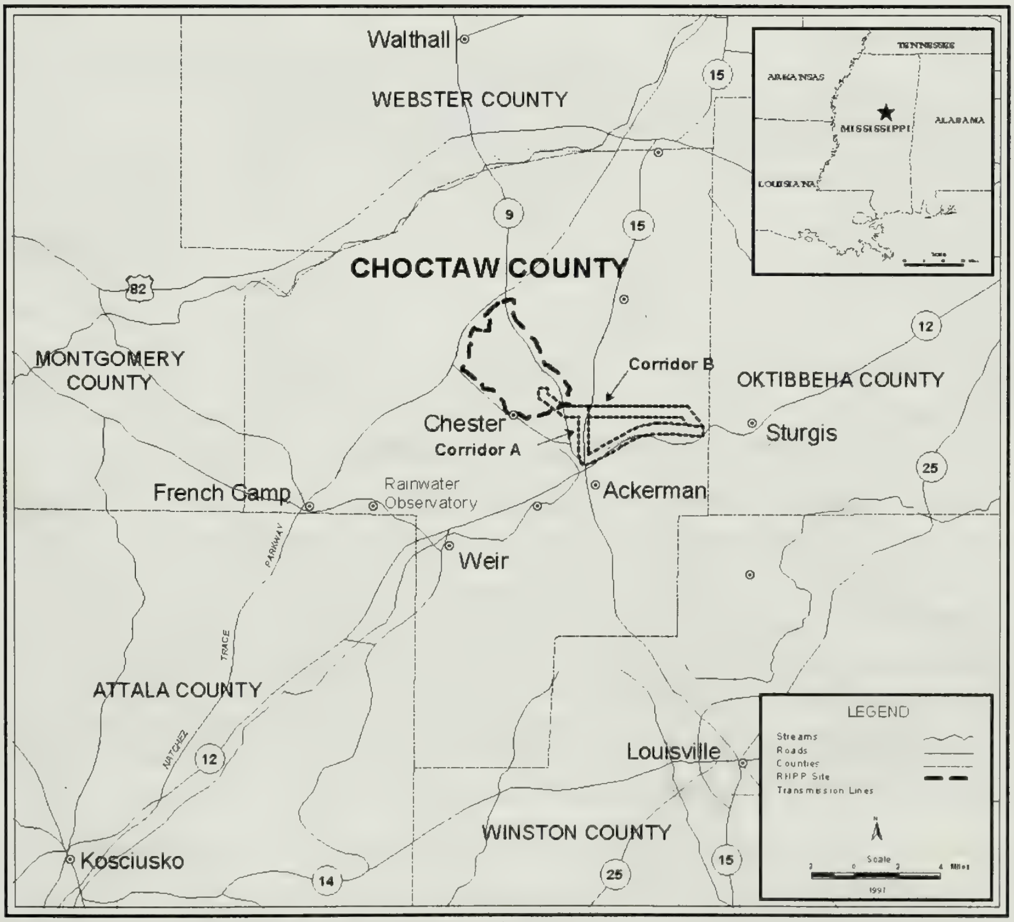
km................................ Kilometer(s)
km^2................................ Square Kilometer(s)
kV................................ Kilovolt(s)
kV/m................................ Kilovolts Per Meter
kWh................................ Kilowatt-hour(s)
lb................................ Pound
lbs................................ Pounds
lbs/ft^3................................ Pounds Per Cubic Foot
lbs/gal................................ Pounds Per Gallon
lbs/hr................................ Pounds Per Hour
lbs/yr................................ Pounds Per Year
m................................ Meter(s)
m^2................................ Square Meter(s)
m^3/yr................................ Cubic Meters Per Year
meq/L................................ Milliequivalents Per Liter
mG................................ Milligauss
mg................................ Milligram(s)
Mg................................ Megagram(s)
mgd................................ Million Gallons Per Day
mg/kg................................ Milligrams Per Kilogram
mg/L................................ Milligrams Per Liter
mg/m^2................................ Milligrams Per Square Meter
$mg/m^2/yr$................................ Milligrams Per Square Meter Per Year
mg/m^3................................ Milligrams Per Cubic Meter
$miles^2$................................ Square Mile(s)
mL................................ Milliliter(s)
mm................................ Millimeter(s)
MMBtu................................ Million British Thermal Units
MMcf................................ Million Cubic Feet
mph................................ Miles Per Hour
mrem................................ Millirem
Mton................................ Thousand Tons
MW................................ Megawatt(s)
ng................................ Nanogram(s)
NTU................................ Nephelometric Turbidity Units
ppb................................ Parts Per Billion
ppm................................ Parts Per Million
ppt................................ Parts Per Trillion
psig................................ Pounds Per Square Inch Gauge
scf................................ Standard Cubic Foot (Feet)
scfm................................ Standard Cubic Foot (Feet) per Minute
stpd................................ Short Tons Per Day
SU................................ Standard Units, a measurement of pH
TON................................ Threshold Odor Number
tpd................................ Tons Per Day
tph................................ Tons Per Hour
tpy................................ Tons Per Year
yd^3................................ Cubic Yard(s)

EXECUTIVE SUMMARY

Introduction

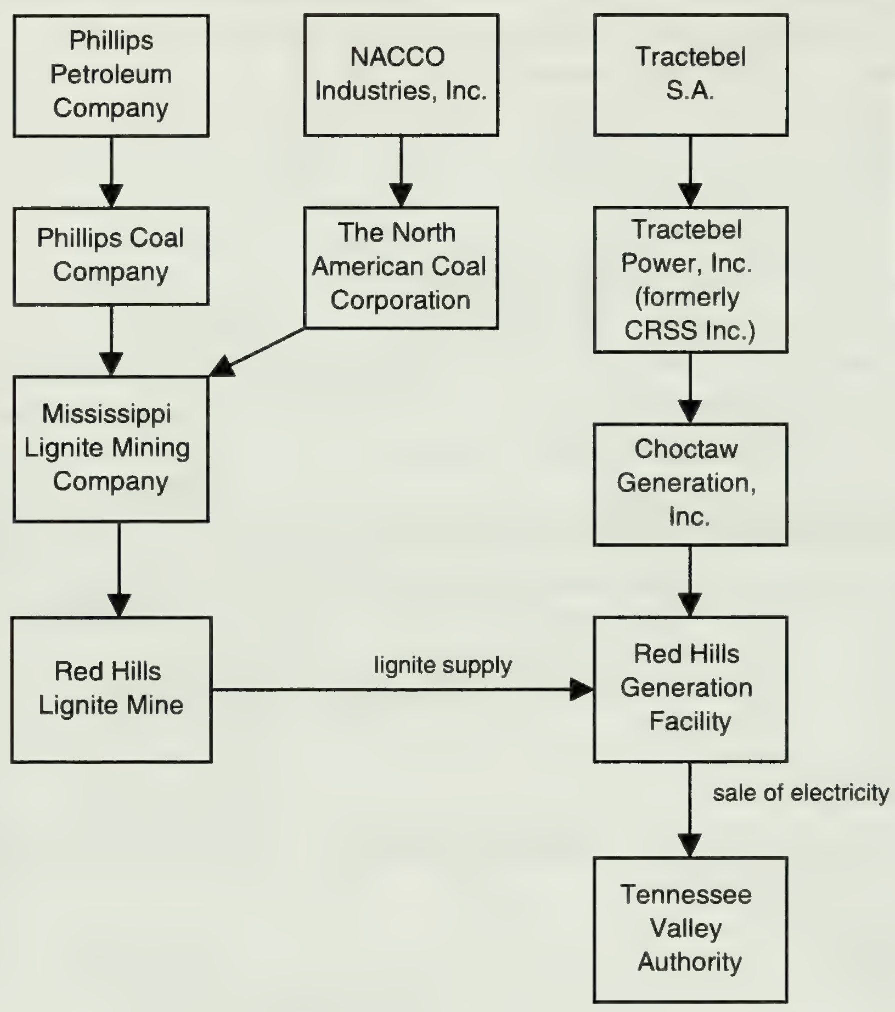
The Red Hills Power Project (RHPP) consists of the Red Hills Generation Facility (RHGF), the Red Hills Lignite Mine (RHLM), and associated project components. A location map and an organization chart of the RHPP are shown in Figures 1 and 2, respectively. The proposed generation facility would be owned and operated by Choctaw Generation, Inc. (CGI), headquartered in Ackerman, Mississippi. CGI is a subsidiary of Tractebel Power, Inc. (TPI, formerly known as CRSS Inc.), which is based in Houston, Texas. TPI is a wholly owned subsidiary of Tractebel S.A., which is headquartered in Brussels, Belgium. The proposed mine would be owned and operated by Mississippi Lignite Mining Company (MLMC), a joint venture of Phillips Coal Company (PCC) and The North American Coal Corporation (NAC), with headquarters in Ackerman, Mississippi. A subsidiary of Phillips Petroleum Company, PCC has headquarters in Richardson, Texas. NAC, based in Dallas, Texas, is a subsidiary of NACCO Industries, Inc.

Figure 1. Location of Red Hills Power Project



MAPS PREPARED BY TVA LAND MANAGEMENT GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

Figure 2. RHPP Organization Chart



The principal parties involved in the RHPP are Choctaw Generation, Inc. (CGI) and Mississippi Lignite Mining Company (MLMC). Both parties are essentially private applicants to TVA and, as such, are responsible for the design of various project components and the siting of those components. TVA has little or no control over project-related decisions made or proposed by CGI or MLMC. Its control is largely limited to deciding whether to purchase power from the proposed facility and how to connect the facility to the TVA power distribution system. Some of the project components fall under COE's regulatory jurisdiction for wetlands and other waters of the U.S. The COE can require that certain potential impacts be avoided or mitigated through Section 404 of the Clean Water Act.

Overview

TVA evaluated future demands for electricity in its power service area and methods for meeting this demand in its *Energy Vision 2020–Integrated Resource Plan/Environmental Impact Statement*, published in 1995. TVA's adopted method is a combination of customer service option, such as conservation and beneficial electrification, and supply-side options, such as upgrading existing facilities, purchasing and exercising call options, and purchasing power from independent power producers. TVA's proposed action evaluated here would be the purchase of power from an independent power producer.

The purpose of TVA's proposed action to purchase electricity generated by the RHPP is to provide a source of power to meet the growing demand for power by electricity users in the TVA region. The purpose of the COE's action is to respond to requests for its approval to issue the required permits.

TVA proposes to purchase the electricity generated by the RHPP and to construct a new transmission line connecting the generation facility to TVA's electrical distribution system. The purchase of electricity by TVA would result in the construction and operation of both the Red Hills Generation Facility (RHGF) and the Red Hills Lignite Mine (RHLM), as well as the environmental impacts associated with these activities.

Description of Primary Components of RHPP

The primary components of the RHPP are a generation facility, a mine, a transmission line, and a natural gas pipeline. Each of these components are described in detail in the following sections.

Generation Facility

Combustion Boiler

The RHGF would use two circulating fluidized bed (CFB) boilers feeding a single steam turbine with a net output of 440 megawatts (MW) (500 MW gross) of electricity. In a CFB combustion system, lignite and limestone are both injected into the combustion chamber, where they are burned in a "bed" held in a fluid state by upward jets of hot air. The calcium in the limestone combines with sulfur gases emitted by the burning lignite, resulting in an ash that contains the sulfur compounds.

CFB boilers also offer high flexibility in handling fuels of varying volatiles content, surface moisture, and heating content. Because of their relatively low combustion temperature, NOx emissions and ash deposits and slagging within the boiler are low compared to traditional pulverized coal boilers. Use of CFB boilers also eliminate the need for SO_2 removal by wet flue-gas scrubbers and are a clean-coal technology.

The RHGF would also be designed to be co-fired with wood waste for up to 5% of the maximum boiler heat input. Typical fuel consumption rates would be 424 tons/hour (3 million tons/year) of lignite and 35 tons/hour (245,000 tons/year) of wood waste. About 34 tons/hour (235,000 tons/year) of limestone would be used as a sorbant. All of the lignite would be supplied by the adjacent RHLM. Wood waste

would be trucked to the site from local sources and the limestone would be trucked to the site, at the rate of about 175 trucks/week, from existing quarries in the region.

Cooling System

The RHGF would use a wet mechanical draft cooling system. This system pumps cooling water through the steam condenser, where it is heated, to the top of the cooling tower, where it then falls to the bottom of the tower to be collected and pumped back to the condenser. Large fans maintain a continuous upward draft through the tower, and the heated water is cooled by evaporation as it falls through the draft in the tower. This system operates efficiently in a wide range of weather conditions and requires little land besides that occupied by the cooling tower.

Water Supply System

The generation facility would require a continuous source of 4,600 gallons/minute (6.33 million gallons/day) of raw water to replace cooling tower evaporation and for other facility uses. The potential of groundwater aquifers at different depths to meet the facility raw water supply needs was evaluated on the basis of aquifer depth, recharge rate, and water quality. Based on available groundwater information, as well as results from a test well, CGI proposes to supply the facility with water pumped from three wells in the Massive Sand aquifer of the Tuscaloosa Aquifer System at depth of about 3,000 feet.

Wastewater Handling System

The RHGF would operate as a zero-discharge system. This method would use a system such as a water softener, reverse osmosis, or evaporator to remove silica and dissolved salts from cooling tower blowdown water. The treated water would be returned to the cooling water system and the remaining salts and other solids would be disposed of in an approved offsite landfill.

Lignite Mine

Mine Development Activities

Prior to the actual removal of lignite, several mine development activities would occur. Access roads and support facilities including office, shop, and warehouse buildings would be constructed. A lignite handling facility, where lignite is transferred from the mine to the RHGF, would be built. Several water control structures, including sedimentation ponds and stream diversions, would also be built.

Mining

Nine seams of lignite occur in the Red Hills area. Based on their thickness and layering, the composition of the overburden, and the energy content of the lignite, surface mining was determined by MLMC to be the only practical mining method. Only six seams can be economically mined. Surface mining would also maximize the resource recovery and, consequently, the royalties to landowners.

Each area to be mined would first be cleared of vegetation and any buildings. Lignite would be mined from a series of successive, rectangular pits averaging 127 acres of surface area, gradually moving from

the south to the north. The RHLM would use a combination of overburden removal techniques. Diesel- or electric-powered shovels would remove overburden above the uppermost lignite seam and load it into large dump trucks, which would haul it from the area. Large dozers would remove overburden from the next three seams by pushing it into the adjacent mine pit. A dragline with a bucket capacity of 79 yd^3 would then be used to remove overburden from the lowest two lignite seams. This electric-powered dragline would operate from one of the lower benches within the mine pit.

Following overburden removal from each seam, dozers fitted with ripper attachments would rip the exposed lignite seam. A diesel-powered hydraulic backhoe would then remove the lignite and dump it into large capacity dump trucks which would haul it from the pit to the mine-generation facility lignite transfer point.

Reclamation

Overburden Replacement Methods – Rough backfilling and grading operations for overburden replacement in the mined-out pits would be conducted. Final backfilling and grading operations would be accomplished. The selected overburden materials would be replaced in a manner that would prevent excessive compaction and achieve an approximate uniform stable thickness of no less than four feet of material, consistent with the proposed postmining land uses, and original contours and drainage patterns.

Topsoil Substitution – Topsoil substitution consists of removing selected overburden materials and spreading them over the area being reclaimed, as discussed in the backfilling and grading operations. Based on a comparison of available native soils data and available overburden data, this reconstructed soil is anticipated to be of comparable or higher quality than existing native soils. MLMC proposes to use selected overburden material in the top four feet as the topsoil substitution at RHLM.

Description of Other Project Components

Transmission Lines

In order to connect the proposed generation facility to TVA's existing electrical transmission system, TVA would build a double-circuit, 161-kV transmission line from the proposed facility to TVA's existing Sturgis, Mississippi, 161-kV substation. TVA would also expand the switchyard facilities in the existing Sturgis substation to accommodate the new 161-kV transmission line.

TVA uses several criteria in selecting potential transmission line corridors. Efforts are made to follow existing linear features such as railroads, pipelines, and other transmission lines, and to avoid or minimize crossing streams, wetlands, and large forested tracts. To the extent practical, routes are also selected to avoid areas of incompatible land uses and to maintain minimum distances of 300 feet from homes and 1,000 feet from schools. Using these siting criteria, TVA identified two alternative corridors, A and B, for the transmission line shown on Figure 1. The corridors are 10.3 and 10.9 miles long, and overlap at their western ends. For study purposes, each of these corridors would be 2,000 feet wide. The width of the final right-of-way (ROW) within the corridors would vary between 100 and 175 feet. In

order to supply electricity to the mine, 4-County Electric Power Association (the local electrical distributor) would build a new substation near their existing Ackerman substation and a 69-kV transmission line from the new substation to the mine office area. This line would be about six miles long and mostly within the existing transmission line ROW.

Natural Gas Pipeline

The proposed generation facility would require up to 19,000 standard cubic feet per minute (1,150 million Btu/hour) of natural gas during startup of the main lignite-fueled boiler units and to heat the auxiliary boilers when the main units are shut down or operating at low loads. An additional amount of natural gas could also be required by EcoPlex tenants. These gas needs would be supplied by a single eight-inch pipeline built and operated by the Town of Weir. The pipeline would be built within Corridor A shown on Figure 1.

Construction and Operation Schedule

Generation Facility

Construction activities of the generation facility would begin in the fall of 1998 and continue through 2000. Electrical generation would begin during the last quarter of 2000.

Lignite Mine

Mine area development activities would begin in late 1998. The actual mining of lignite would begin in mid-2000, in tandem with electrical generation by the RHGF.

No Action Alternative

Under the No Action Alternative, TVA would not purchase electrical power generated by the RHPP. TVA would also not construct a transmission line connecting the generation facility to the TVA power distribution system. Any environmental impacts associated with TVA's purchase of this electrical power from RHPP would not occur. In order to meet its anticipated power demands, TVA would consider other energy resource options assessed in *Energy Vision 2020–Integrated Resource Plan/Environmental Impact Statement*, completed by TVA in 1995. However, TVA's decision not to purchase electricity from this project would not preclude development of the mine and/or generation facility. If TVA does not buy the power, the energy developed through this project could be sold to another purchaser and lignite could still be mined. Thus, the potential impacts identified in the Action Alternatives may not necessarily be avoided by TVA's No Action Alternative.

EcoPlex

Choctaw County, with assistance from the state of Mississippi, plans to develop the Red Hills EcoPlex industrial park near the generation facility. The EcoPlex would combine various manufacturing businesses at a common location to help achieve the highest levels of efficiency in terms of energy consumption and joint feedstock/waste utilization. Industries locating in the EcoPlex would use steam,

carbon dioxide, and/or ash from the generation facility, as well as byproducts from other EcoPlex tenants in their manufacturing processes. The Red Hills area was chosen for EcoPlex development because of the opportunities to leverage the planned generation facility project into a larger development opportunity for Choctaw County and the surrounding region.

When fully occupied by tenants, the proposed EcoPlex industrial park area would be about 1,500 acres in size. About 500 acres would be available during the initial development phases. About 1,000 acres are expected to be developed.

Based on the results of a Master Plan prepared for the state of Mississippi in 1997 by Mississippi Energy Consultants, with the assistance of Arthur Andersen, the industries listed below are being recruited as early tenants of the EcoPlex.

- Greenhouse – Two types of greenhouse operations are likely EcoPlex tenants. One type is hydroponic gardening, also known as controlled-environment agriculture. This operation would grow high-value crops such as tomatoes, lettuce, cucumbers, and herbs, with the plant roots suspended in a liquid nutrient solution or in a synthetic soil substitute such as perlite. The other type is a more traditional greenhouse operation, growing potted ornamental indoor plants, flowers, and vegetable seedlings. Both greenhouse types could use carbon dioxide from the generation facility exhaust stack to stimulate plant growth and could use steam from the facility for winter heating. Three separate greenhouse operations are planned for the EcoPlex.
- Aquaculture – This operation would raise fish, most likely tilapia, in enclosed tanks heated by steam from the facility. Tilapia are members of the perch family native to Africa. The aquaculture operation would be integrated with the hydroponic gardening operation and water would circulate through the tanks of the two operations. The aquaculture operation would likely cover at least two acres and raise at least 560,000 lbs of fish per year. Other species which could potentially be raised in this aquaculture operation are catfish, freshwater shrimp, crappie, and hybrid bream. Three aquaculture operations are planned for the EcoPlex.
- Kenaf Pulp Mill – This operation would process pulp from kenaf. Kenaf is an annual plant native to east-central Africa, closely related to cotton and okra, and easily cultivated in Mississippi. A kenaf pulping operation would likely use a zero effluent thermo-mechanical process because of the water supply and discharge limitations of the Red Hills area. A likely end use of the kenaf pulp is manufacturing fiberboard panels. Other potential end products include particleboard panels and paper. The pulping operation would likely use steam from the facility. One kenaf mill is planned for the EcoPlex.

Affected Environment

The Red Hills Power Project facilities and structures would be located on a 9,300-acre site in Choctaw County, Mississippi. Pertinent information about environmental resources located in or near the site expected to be affected are summarized in Table 1.

Table 1 Affected Environment

RESOURCE	EXPLANATION
Air Resources	Area in attainment for all criteria pollutants; regional air quality generally good; ozone concentrations meet the new eight-hour standard. Closest significant source beyond 30 miles. Tendency for air stagnation in summer and early fall.
Geology	Site lies entirely in the Wilcox Group. Clay, silt, sand, and lignite deposits are predominant; overburden generally non-acidic (oxidized samples contain no pyritic sulfur); iron ore is too deep and discontinuous to mine; clay deposits are mostly impure; sand is abundant. Low regional seismic hazard.
Soils	72% of area is upland soils, mostly forested. Bottomland soils comprise 28% and include 2,765 acres of prime farmland soils, very small acreages are cropped. Only 0.8% are hydric soils. Soils are strongly acidic. Heavy metal concentrations are low.
Groundwater	Area drinking water primarily from Lower Wilcox Aquifer wells; availability is moderate; water quality generally meets water quality standards. The second major source is the Tuscaloosa Aquifer System (TAS), which is deeper, has poorer water quality, and lower zones that are not used for drinking water.
Surface Water	Surface waters include Big Bywy Ditch, Little Bywy Creek, Middle Bywy Creek, Stewart Creek, Besa Chitto Creek, and several ponds, a few are used for stock watering. No permitted consumptive uses. Characterized by low total dissolved solids and neutral pH. All water quality standards are met, except occasional low pH values.
Aquatic Ecology	Area surface waters support diverse insect, crayfish, mussel, and fish communities and are typical of the area.
Wetlands	Area of wetlands historically reduced by channelization. 0.8% (67 acres) of the RHPP area is wetlands; additional wetlands occur in the utility corridors. Predominant wetland types are palustrine forested and palustrine emergent found near upland seepages and old stream channels.
Floodplains	Site mostly upland with narrow floodplains. No local floodplain regulations.
Terrestrial Ecology	Site within Oak-Pine Forest Region; no virgin or old growth forest present. Hardwoods, pines, recent clear-cuts, and crop/hay/pastureland predominate. Diverse plant and wildlife communities. A few uncommon plant communities on the site. Two state natural areas near transmission line corridors.
Threatened or Endangered Species	No federally-listed threatened plant or animal species present in project area; seven state-listed plants present on the site. One state-listed fish, the chestnut lamprey, was found downstream of site.
Land Use	9,300-acre study area is largely undeveloped. Land use is primarily forest (about 7,600 acres) including sawtimber hardwoods and loblolly pines; about 1,200 acres are in pasture/grass/hay. Land use in the utility corridors similar. Current value of timber on RHPP site and utility corridors averages $650/acre. Approximately 166 residences are located in the study area.
Cultural Resources	Site close to historic Natchez Trace Parkway. 54 archeological sites present on the first five-year mine area. Seven sites (five historic, two prehistoric) to be tested for eligibility for the National Register of Historic Places.
Socioeconomic	Area population growth rate is considerably slower than the State. Jobs predominantly blue collar, with majority in government and manufacturing. Adequate community/municipal services and housing.
Environmental Justice	The proportion of minority, lower income, and aged population are all less in the project area than in Choctaw County and/or in the State.

Table 1 Affected Environment

RESOURCE	EXPLANATION
Transportation	Nearest railroad and airport are in Ackerman, five miles from the site. Six airports are within a 110-mile radius. The site is crossed by several gravel roads and three paved roads. Several state and county two-lane highways surround the project area to serve the local traffic flow, including the Natchez Trace Parkway. None of these roads are at capacity.
Public Health	Ambient air quality meets NAAQS standards; annual natural radiological dose is 290 mrem/yr which is insignificant.
Hazardous and Solid Waste	No active onsite disposal area exists and there are no known hazardous wastes onsite. Adequate capacity for waste generation quantities at existing offsite waste disposal facilities.
Noise Conditions	Levels are slightly higher than typical of a medium density rural community; local sources of noise include Highway 9, residential, natural (e.g., insects and tree frogs), and sporadic timber cutting.
Recreation	Major public recreation area is adjacent to Natchez Trace Parkway, including the 200-acre Little Mountain Overlook/Jeff Busby developed area, on the northwestern side of the RHPP site. Primary recreation activity on RHPP site is hunting. Other recreation facilities are available in the surrounding area.
Visual Resources	Harmonious mosaic of rural landscape; some clear-cuts and a few manmade structures (water & radio towers, transmission lines) visible; unique night sky darkness important to nearby Rainwater Observatory and Planetarium. Adjoins visually-sensitive historic landscape of Natchez Trace Parkway.

Environmental Consequences of the Proposed Actions

The effects of constructing and operating the generation facility, lignite mine, and the associated transmission lines and natural gas pipeline are summarized in Table 2. Most environmental impacts associated with the construction and operation of the Red Hills Power Project and its associated ancillary facilities are not expected to be significant. Some of the socioeconomic impacts expected as a result of the construction and operation of the facility are expected to be positive (new jobs, tax payments, etc.).

Cumulative Impacts

The state of Mississippi and Choctaw County have indicated that they intend to cooperate on the development of an EcoPlex industrial park that would be located adjacent to the proposed generation facility. It is contemplated that occupants of the EcoPlex would be designed to share resources with and use wastes from the RHPP in the course of their activities. The proximity of the EcoPlex to the generation facility and its industrial nature means that it is likely that its development and operation would impact environmental resources that are common to resources potentially impacted by the RHPP. These "cumulative" impacts have been assessed in this EIS. There are no other major activities that have been proposed in the area that are likely to have material cumulative impacts with the RHPP.

There would likely be cumulative impacts to air quality in the area. However, applicable federal and state air pollution control requirements would ensure that any such cumulative impacts are kept within acceptable levels. Any major source of air pollution locating in the EcoPlex would have to limit its emissions in a manner to maintain compliance with EPA's ambient air quality standards and Prevention of Significant Deterioration requirements. The estimated cumulative loss of prime farmland soils would be acceptable, based on National Resource Conservation Service guidelines. Cumulative impacts to groundwater, surface water, aquatic ecology, wetlands, floodplains, and rare plants and animals would be negligible. Cumulatively, over 2,000 acres would eventually be converted from forest and agricultural uses to long-term industrial uses. This would constitute an important local impact on plant and animal populations as well as local land use, but would not be important from a state or regional perspective. Area noise levels, highway traffic, and demand for recreational facilities would increase while visibility of the night sky would decrease. The cumulative socioeconomic impacts would be positive through job creation, increased tax collections, and increased property values.

Preferred Alternative

TVA's preferred alternative is to purchase the electricity generated by the RHPP, and to construct the connecting transmission line within Corridor A. The generation facility, lignite mine, and utility connections would be built and operated as described in this document.

By selecting this alternative, TVA would fill a portion of its need for a new, competitively-priced supply of electricity. The project would result in significant local socioeconomic benefits and acceptable environmental impacts.

Regulatory Requirements

Many activities described in this EIS would require review and consultation with other federal and state agencies. Most activities would also require permits and approvals from federal, state, or local agencies. Environmental permitting processes help prevent unacceptable environmental impacts and safeguard important environmental resources. Table 3 lists relevant statutes and Executive Orders.

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
4.2 Air Resources	Minor and transient impacts during construction related to land clearing and site preparation (fugitive dust), vehicular traffic, open burning, and internal combustion engine operation would be insignificant and would not lead to violations of any air quality standards. Compliance with air quality permit conditions would assure that air pollutants associated with lignite combustion are not significant. The RHGF stack plume might be visible from the Little Mountain Overlook 25 days/year. Other air quality and visual impacts from facility plumes would be insignificant.	Minor and transient impacts during construction related to land clearing, site preparation, vehicular traffic, open burning, and internal combustion engine operation would be insignificant. Mine operations would have no stationary sources of particulate air emissions. Particulate and exhaust emissions resulting from mining operations would not exceed PSD increments or NAAQS, and are considered insignificant.	Minor and transient impacts during construction related to land clearing, grading, and open burning would be insignificant.
Commitments	• Compliance with applicable federal, state, and local regulations would minimize potential offsite impacts from open burning during construction. • Air emission permit from Mississippi Office of Pollution Control (MOPC) would ensure compliance with all state and federal air quality standards (NAAQS, PSD, NSPS, and NESHAPS).	• Compliance with applicable federal, state, and local regulations would minimize potential offsite impacts from open burning during construction. Operational control measures such as minimizing haul distances, spraying water on roads, and proper reclamation of disturbed areas would reduce the potential for fugitive dust and exhaust emissions.	• Compliance with applicable federal, state, and local regulations would minimize potential offsite impacts from open burning during construction.
4.3 Geology	Loss of sand deposits in the project area would be insignificant. No impacts expected on or from seismicity.	Loss of sand deposits in the project area would be insignificant. Removal of lignite deposits within the 3,800-acre area to be mined represents only a small fraction of the total area over which mineable lignite is present in northeastern Mississippi, and is considered insignificant. Overburden removal would cause a significant change to current stratigraphy. The	No impact.

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
		postmining topography would be similar to original conditions, but with gentler slopes.	
Commitments	• Adherence to seismic provisions of national model building codes.	• Backfilling and grading to replace the overburden would be contemporaneous with mining. The top four feet of selected overburden material would be non-acid forming, non-toxic forming, and non-combustible materials to create a growth medium that is equal to or greater than the native soils.	• None
4.4 Soils	Construction would impact 390 acres, including 44 acres of the Besa Chitto Creek bottomlands. Impacts from construction erosion would be temporary and can be mitigated as described below. Potential impacts on soils from operations from ash management and parking lot/road runoff can be mitigated as described below and are considered insignificant.	Construction would impact 1,900 acres. Operations would impact 3,800 acres over a 37-year period. 1,834 acres are prime farmland soils, but none are classified as historic cropland. Impacts from construction erosion would be temporary and can be mitigated as described below. The truck/shovel fleet would minimize compaction during reclamation, but a ripper would be used where necessary. Potential impacts to soils in mine area would be temporary and can be mitigated as described below. Where soil reclamation results in improved soils, impacts would be beneficial.	Construction would not adversely impact prime farmland soils. Erosion impacts during construction would be temporary and can be mitigated as described below. Localized, permanent soil compaction resulting from construction would be insignificant. Impacts to 14 acres of hydric soils are discussed in Section 4.8, Wetlands.
Commitments	• Use of Best Management Practices (BMPs) such as silt fences, hay bales, and revegetation for erosion control. • Construction of stormwater runoff sumps, and proper revegetation to minimize	• Use of BMPs such as silt fences, hay bales, settling sumps, runoff diversion structures, sedimentation ponds, and revegetation for erosion control. • The use of selected	• Use of BMPs such as silt fences, hay bales, and revegetation for erosion control.

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	erosion/sedimentation. • Provision of curbed or diked areas around fuel, oil, and chemical storage facilities. • Use of Spill Prevention Control and Countermeasure (SPCC) Plan.	overburden materials to create a soil productivity level and slope equal to or better than existing conditions. • Provision of curbed or diked areas around fuel, oil, and chemical storage facilities. • Use of SPCC Plan. • Use of appropriate management procedures for stockpile overburden to control leachate and runoff.	
4.5 Groundwater	Shallow groundwater from the Wilcox aquifer would be used for construction purposes. Impacts from these activities are expected to be insignificant. Operations would require 6.33 mgd of makeup-water drawn from the TAS aquifer. Predicted drawdowns in the TAS aquifers would result in small increases in pumping lifts, but no pump modifications. The potential impact of groundwater use on existing and future TAS users, and users of aquifers above the TAS are considered insignificant. The potential for water degradation and possible land subsidence, saltwater encroachment and upconing are considered insignificant.	The effects on groundwater resources from construction activities including groundwater use, excavation, and grading would be insignificant given the limited depth and area of disturbance. 18 wells and springs in and near the mine could be impacted by mine operations; none are public water supplies. These impacts would be mitigated as described below. Impacts of long-term changes in hydraulic properties of the overburden would be insignificant. With the measures described below, acid-forming or toxic materials are not expected to cause significant groundwater quality degradation. No adverse impacts are expected from onsite lignite storage.	No impacts expected from construction. Potential impact from ROW maintenance would be insignificant and can be reduced by the measures listed below.
Commitments	• Use of sumps, trenches, and dewatering pits during facility construction to control groundwater as needed. • Compliance with the MDEQ Water Supply permits issued for operation of wells in the TAS. • Compliance with MDEQ solid	• Provision of alternative water supply by the MLMC to impacted owners. • Use of special handling techniques for unoxidized overburden known to contain AFM or TFM (per mine permit overburden	• Use of EPA-registered herbicides labeled for ROW to be applied by licensed personnel, minimizing public exposure and water resource contamination.

Can't say this for life-of-mine period + contrib. to Bywy baseflows.

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	waste disposal regulations.	handling plan). • Construction of anoxic limestone drains or addition of buffering agents should acidic seeps occur.	
4.6 Surface Water	The facility would function as a zero discharge facility for process waters. Sanitary wastewater would be discharged into an approved onsite septic system. Stormwater would be collected and routed to ponds as required to prevent contamination. Potential impacts to surface water from facility construction and operation can be reduced as described below and are considered insignificant.	Impacts from mining/ reclamation on the hydrologic system would be small and limited to areas immediately adjacent to the mine excavation. Peak flows in Little and Middle Bywy Creeks could be reduced. Some springs and seeps on the mine site would not return, but the flow from these is insignificant. Potential impacts to water quality/quantity can be reduced as described below and are considered insignificant.	Potential impacts from increased sediment loads and runoff quantities and other construction impacts would be temporary and can be reduced as described below. Can't say this yet re. baseflow to Creeks.
Commitments	• Maintenance and compliance with NPDES Permit, SWPP Plan, and SPCC Plan. • Use of BMPs in construction and operations.	• Mine permit calls for construction of sedimentation ponds, stream diversions, and erosion control features to protect local surface waters and hydrologic balance. • Approved surface monitoring program and overburden handling plans would be implemented. • If significant acidic seeps occur, anoxic limestone drains and/or other neutralizing features could be put in place. • Compliance with applicable effluent limitations (NPDES Permit, SWPP Plan, and SPCC Plan). • Reclamation activities including permanent impoundments and restoration of streambeds, and approximate drainage patterns.	• Use of project-specific BMPs and daily work procedures.

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	does this include any significant flow loss in ByrY Creeks @ NATR ??	• Use of BMPs in construction and operations. • Provision of alternative water supply by the MLMC to owners as needed.	
4.7 Aquatic Ecology	Runoff and sedimentation from construction activities would be insignificant. No adverse impacts are expected from generation facility operations.	Potential runoff and sedimentation from disturbance can be mitigated as described below. Adverse impacts from increased suspended solids and nutrient loading would be short-term and localized. Diversion of onsite streams to new, unshaded channels would temporarily impact aquatic life. This would be somewhat offset by the creation of new habitats in diversion streams and sedimentation ponds in listed mitigation.	There would be temporary impacts during construction associated with erosion and sedimentation. These impacts are not considered to be significant. Impacts to aquatic life from operations and maintenance would be insignificant.
Commitments	• Use of BMPs during construction including fabric filter fences, hay bale dikes, and sedimentation ponds during construction. • Stormwater runoff would be managed in accordance with the SWPP Plan.	• Use of BMPs during construction and operation including fabric filter fences, hay bale dikes, and sedimentation ponds during construction and operation. • Stormwater runoff would be diverted to the mine site sedimentation ponds by diversion ditches or in accordance with SWPP Plan. • Reclamation activities including permanent impoundments and restoration of streambeds, revegetation, and approximate drainage patterns.	• Use of BMPs for utility corridor maintenance and project-specific BMPs and daily work procedures.
4.8 Wetlands	3.58 acres of wetlands would be eliminated during facility construction. This impact can be mitigated as described below. No impacts from operations are expected.	63 acres of wetlands would be eliminated by grading and clearing activities for construction and operation of the mine. However wetland functions would return over	Minor impacts to wetlands during construction would result from clearing of tall vegetation and temporary soil disturbance.

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
		time. Additional wetlands would be created as a result of mining activities.	Some loss of value of impacted wetlands due to conversion from forested to emergent or scrub-shrub wetland types.
Commitments	• Mitigation of wetlands would be in compliance with the COE permit as documented in the individual permit.	• Mitigation of wetlands would be in compliance with the COE permit and in accordance with the mine permit. Additional wetlands would be created.	• Avoidance of wetlands in transmission line routing to the extent possible. • Use of project-specific BMPs and daily work procedures.
4.9 Floodplains	No impact to floodplains are expected to result from either construction or operations of the facility.	Impacts from construction and operation of the mine are expected to be insignificant. Some benefit would be realized due to flood retention capability of sedimentation ponds.	Construction of transmission lines and the natural gas pipeline would temporarily impact the floodplain. No operational impacts are expected.
Commitments	• Adverse floodplain impacts would be minimized through project design and using BMPs during construction.	• By returning affected areas to premining conditions, as provided for in the mine permit, adverse floodplain impacts would be minimized.	• The natural gas pipeline would be constructed completely underground and the impacted area would be returned to pre-construction conditions. • TVA's BMPs would be used for transmission line construction and maintenance. • ROW would be revegetated where natural vegetation is removed.
4.10 Terrestrial Ecology	Loss of common plant communities and animal habitat from the 390-acre site is not expected to have significant impacts to the state or region. Some deep ravine and habitats could be impacted during construction. No significant impact to vegetation is expected from the operation of the facility. Impacts on wildlife from operating noise would be insignificant.	The temporary and/or permanent loss of common plant communities and animal habitat from the 300-acre mine facility construction area is not expected to have significant impact on the state or region. Operation of the mine is expected to destroy most site vegetation. In particular, the uncommon habitats are not expected to reoccur. Except for the	No significant impacts would be expected. Maintenance of the transmission lines and natural gas pipeline ROWs would result in the perpetuation of early successional plant communities. This is not expected to have a significant impact to the state or region.

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
		uncommon vegetation, the incremental loss of this vegetation over the 37-year life span of the mine is not expected to have negative impacts to the vegetation of the state or region. Loss of diversity of habitat may reduce plant and animal species diversity, locally and temporally.	
Commitments	• Facility design features to maintain regulatory noise levels. • Buffering with trees near facility boundaries as required.	• Specific reclamation activities as stated in the mine permit application, guided in-part by landowner preference. This includes creation of habitat diversity. • Efforts would be made to avoid or relocate unique habitats to the extent practicable. .	• Use of BMPs for construction. • Establishment of riparian buffer zones along ROW crossing streams.
4.11 Threatened or Endangered Species	Construction and operation of the RHPP would have no effect on federally-listed species or proposed species, since none occur in the area. Loss of the state-listed rare plant population found onsite could be minimized by the mitigation listed.	Construction and operation of the RHPP would have no effect on federally-listed species or proposed species, since none occur in the area. Loss of six state-listed rare plant and three wildlife habitats found onsite could be minimized by the mitigation listed.	Utility corridors would be surveyed for listed species in the Spring of 1998. Based on surveys elsewhere in the area, no federally-listed species are expected to occur.
Commitments	• To the extent practicable transplant the state-listed plant population to a protected area prior to construction.	• Specific reclamation activities as stated in the mine permit application, guided in-part by landowner preference. • Creation of habitat diversity for, and either avoidance or transplantation of, state-listed species to a suitable protected site to the extent practicable.	• Impacts to federally-listed species in corridors would be avoided in final line routing. • Impacts to state-listed species in corridors would be avoided where practicable.
4.12 Land Use	Construction and operation of the generation facility would affect land use on about 390 acres. This would result in conversion of about 322 acres of forestland and 66	Construction and operation of the mine and mine support facilities would affect land use on 5,800 acres over 37 years. 85.3% of the mine	Construction and operation of the transmission lines would require the removal of approximately 114 acres

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	acres of pasture and cropland to industrial use, and two acres for other uses. Eleven structures, including five residences, and three small ponds could be removed. Indirect impacts include business and housing development which would likely occur if the project proceeds. However, this development is expected to be limited.	area is forestland. About 40 residences and less than 10 other structures would be removed. Impacts would last for at least eight to nine years from initial clearing activity through reclamation and final bond release. This represents a short-term potential income loss to the landowner. However, the landowner would receive mineral royalties and surface damage payments. (See Socioeconomic Section.) The mine permit application identifies a number of mitigation measures that the mine operator would implement. The impact on the value of timber resources would be beneficial, with an estimated increase in net future value of $45/acre.	of timber valued at $74,000 within the ROW. Construction of the natural gas pipeline, which follows the transmission line ROW, would require an additional 75 feet at the edge of the ROW. Most land uses could resume after construction except for forestry along the utility ROW. Operational impacts from the utility lines would result in long-term but regionally insignificant reductions of forestland.
Commitments	• None	• Mining regulations require that the soil productivity of reclaimed areas be at least equal to or greater than prior to mining. • The mine permit application calls for reclamation activities that would restore land to the land use choice of the surface landowner. However, the majority of the proposed postmining land use has been designated as commercial forestry, interspersed with fish and wildlife features. • Some recreational land use could be created due to the possible permanent retention of the water control pond.	• None
4.13 Cultural and	No adverse impact expected from construction or operation. No	The first five years of mine activities could impact seven	After the utility corridors are identified, they would

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
Historic Resources	historic or archeological sites listed or eligible for inclusion on the National Register of Historic Places occur in the vicinity. Ambient air emissions from facility operations are not expected to adversely impact downwind historic structures.	archeological sites potentially eligible for the National Register of Historic Places. Later mine activities could impact one cemetery.	be surveyed and the results reported in the FEIS. In coordination with the MSHPO, any adverse impacts would be mitigated as indicated.
Commitments	• None	• Any sites determined to be eligible for the Register would either be avoided or any adverse impacts would be mitigated. Mitigation would consist of Phase III data recovery as approved by MLMC, TVA, MSHPO, and the Advisory Council on Historic Preservation as detailed in the proposed Programmatic Agreement (PA). • Surveys would be conducted for any areas to be disturbed outside of the five-year mine area, also as provided for in the PA. • The cemetery would be avoided.	• Any sites determined to be eligible for the Register would either be avoided or any adverse impacts would be mitigated.

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
4.14 Socioeconomics	Employment during construction would average 750, with a three-month peak employment of 1,500. An estimated one-half of the 750 workers would commute; the rest would move within commuting range. RHGF would employee 39 workers. These projected increases are expected to have an insignificant impact on housing, water supply, sewer, health facilities, and crime. Impacts would be beneficial to local government revenues and land values. Two school systems, some fire protection services, and some local law enforcement systems may experience temporary impacts during construction.	Employment during construction would average 112, with a five-month peak employment of 150. An estimated one-half of the workers would commute, the rest would move within commuting range. Mine operation employment would average 131. These projected increases are expected to have an insignificant impact on housing, water supply, sewer, health facilities, and crime. Impacts would be beneficial to local government revenues and land values. Two school systems, some fire protection services, and some local law enforcement systems may experience locally significant impacts.	No impacts are expected.
Commitments	• Work with the area advisory groups to determine how best to mitigate any impacts. • Where practicable, hire local employees and make local procurements. • Would implement safety training programs. • Permit available water supply for fire protection onsite. • Would provide fire training programs to facility employees.	• Where practicable, hire local employees and make local procurements. • MLMC would implement extensive safety training programs. • MLMC would provide EMT training to mine employees. • Permit available water supply for fire protection. • MLMC would provide extensive fire training programs to mine employees.	• None
4.15 Environmental Justice	The proportion of minority, lower income, and aged population are all less in the project area than in Choctaw County and/or in the State. Therefore no impact is expected.	The proportion of minority, lower income, and aged population are all less in the project area than in Choctaw County and/or in the State. Therefore, no impact is expected.	The proportion of minority, lower income, and aged population are all less in the project area than in Choctaw County and/or in the State. Therefore, no impact is expected.
Commitments	• None	• None	• None
4.16	Impacts to rail or air transportation	Impacts to rail or air	Impacts of construction of

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
Transportation	would be insignificant. Traffic impacts from operations would be insignificant with only slight reductions in levels of service on nearby roads. Impacts from annual maintenance outages would be short-term and transitory. During peak construction periods, levels of services would be more substantially impacted but this would be temporary.	transportation would be insignificant. Impacts to roads from construction and operation would be insignificant. Mine operations would result in closing and/or relocating several county roads over the life of the mine. During peak construction periods, levels of services would be more substantially impacted but this would be temporary.	the natural gas pipeline on local roadways would be temporary and could be mitigated as indicated below. Impacts from construction and maintenance of the transmission lines would be insignificant.
Commitment	• Stage delivery of large equipment during non-peak traffic hours. • Control traffic as required. • Discourage employees from commuting on Natchez Trace Parkway. • No truck deliveries via Natchez Trace Parkway.	• Road closure and alteration plans would be reviewed by the Choctaw Co. Board of Supervisors for approval. • Public roads would be reconstructed in their original location or a more suitable location as approved by the county. All roads would be rebuilt to existing standards or better. • Surface owners would retain access to lands, although access to land being mined would be controlled by MLMC for safety purposes. • Discourage employees from commuting on Natchez Trace Parkway. • No truck deliveries via Natchez Trace Parkway.	• Construction of the natural gas pipeline would be overseen by the MS Public Service Commission Division of Pipeline Safety to minimize any possible impacts.
4.17 Public Health	For construction, limited impacts are expected on emergency medical response. No operational impacts are expected on emergency medical response. Two hazardous materials would be present during operations—gaseous chlorine and natural gas. These present limited potential for adverse impacts for toxic gas or vapor release. Radiological impacts of operations	For construction, limited impacts to emergency medical response. For operations, limited impacts to emergency medical response and from air pollutants are expected.	No impacts to public health through increased exposure to EMF or impacts to emergency medical response are anticipated.

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	are insignificant.		
Commitments	• Coordinated emergency medical services planning. • Compliance with NAAQS regulations.	• Coordinated emergency medical services planning.	• None
4.18 Hazardous and Solid Waste	Only limited quantities—less than 220 lbs/month—of hazardous waste would be generated during construction and operating phases of the generation facility. The risks associated with these wastes can be lessened as described below. Potential Impacts from non-hazardous solid waste (notably ash) are not expected to be important and can be reduced by the measures listed below.	Only limited quantities—less than 220 lbs/month— of hazardous waste would be generated during construction and operation phases of the lignite mine. The risks associated with these wastes can be lessened as described below.	No impacts from hazardous waste or solid waste are expected.
Commitments	• Use of strict chemical storage and safety programs. • Compliance with applicable OSHA regulations. • Registration with EPA as a Conditionally Exempt Small Quantity Generator or Small Quantity Generator. • Manage hazardous waste in accordance with applicable RCRA regulations. • Design and construction of ash management unit in accordance with MDEQ permit. • Maximize beneficial use of ash. • Implementation of applicable Pollution Prevention Plan.	• Use of strict chemical storage and safety training programs. • Registration with EPA as a Conditionally Exempt Small Quantity Generator or Small Quantity Generator. • Hazardous waste would be managed in accordance with applicable RCRA regulations. • Implementation of the mine permit application requirements for waste management. • Implementation of applicable Pollution Prevention Plan.	• Proper disposal of all wastes.
4.19 Noise	No hearing loss or speech intelligibility impact on residents from noise is expected during construction or operations. Other impacts from noise are expected to be insignificant.	No hearing loss or speech intelligibility impact on residents from noise is expected during construction or operations. Other impacts from noise are expected to be insignificant.	No hearing loss or speech intelligibility impact on residents from noise is expected during construction. Other impacts from noise are expected to be insignificant. Impacts from maintenance of transmission line and natural gas pipeline corridors is expected to

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
			be local, short-term, and insignificant.
Commitment	• Limit construction activity as much as practicable to the daytime hours. • Design generation facility features to maintain regulatory noise levels. • Buffer with tree plantings near facility boundaries as required.	• Design activities to minimize noise to extent practical.	• None
4.20 Recreation	No loss of general public recreation opportunities would occur, because all property is privately owned. Impacts to general public recreation from permanent employees would be insignificant. Construction and operational impacts on hunting clubs would be insignificant. The sights and sounds of construction could impact recreation, but such impacts can be mitigated as described below.	No loss of general public recreation opportunities would occur, because all property is privately owned. Construction and operational impacts on hunting clubs would be insignificant. The sights and sounds of construction could impact recreation, but such impacts can be mitigated as described below. Recreational uses would improve if water control ponds are retained after mining.	No impacts.
Commitments	• As listed in Sections 4.19 and 4.21.	• As listed in Sections 4.19 and 4.21.	• None
4.21 Visual Resources	Some significant impacts—lighting and destruction of vegetation—from construction and operation would occur. These impacts would be localized and temporary. These potential impacts can be mitigated as described below.	Some significant impacts—lighting and vegetation removal—from construction and operation of the mine would occur. These potential impacts can be mitigated as described below. There would be few long-term visual impacts from the mine operation.	Clearing the ROW for the transmission lines and natural gas pipeline would impact the visual landscape.
Commitments	• Commit to use "dark sky" lighting as practical. Use shielded low-pressure sodium lighting. • Minimize installation of lighting fixtures. • Implement operational plans that minimize lighting. • Use dual stack lighting system in accordance with FAA Advisory	• Commit to use "dark sky" lighting. • Mine reclamation activities as detailed in the mine permit, including: ◊ Work with the NPS on management of foreground vegetation along Parkway.	• After construction, the transmission lines and structures would affect a permanent change in visual landscape. • Maintenance of both the transmission line and natural gas pipeline ROW would add to the

Table 2 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	Circular AC 70/7460-IJ. • Retain dense vegetative buffer around the ash management unit. • Use flat color in the medium cool-gray range for the exterior of the facility. • Use of tree plantings and landscaping to minimize impacts around facility.	◊ Control discharges to achieve no perceptible difference in water quantity or quality under the Parkway. ◊ Control fugitive dust emissions with two 12,000-gallon water trucks. ◊ Train employees to be sensitive while working near Parkway. • 2,000-foot set back of lignite recovery operations from the Natchez Trace Parkway to provide vegetation screening. • Keep the dragline low in the pit to limit its visibility.	visual impact.

Table 3 Relevant Environmental Authorities
Statute
Archaeological and Historic Preservation Act of 1974 (16 U.S.C 469)
Clean Air Act, as amended (Public Law 88-206)
Clean Water Act, as amended (Public Law 95-217)
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Public Law 96-510), as amended by the Superfund Amendments and Reauthorization Act of 1986 (Public Law 99-499)
Emergency Planning and Community Right-to-Know Act of 1986 (42 USC 11001 et seq.)
Endangered Species Act of 1973, as amended (Public Law 93-205)
Farmland Protection Policy Act of 1984 (7 U.S.C. 1539-1579)
Federal Aviation Act (49 U.S.C. 1304 et seq.)
Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661, et seq.)
Mine Safety and Health Act (Public Law 910173 as amended by P.L. 95-164)
Mississippi Solid Waste Act (Mississippi Code, 1972, Sections 17-17-1 et seq., as amended)
Mississippi Water Rights Act (Mississippi Code, 1972, Section 51-3-1 et seq., as amended)
Mississippi Water Laws (Mississippi Code, 1972, Section 51-3-39 et seq., as amended April 1, 1985)
Mississippi Surface Coal Mining and Reclamation Law, Section 53-9-1, et seq., as amended
National Environmental Policy Act of 1969 (Public Law 91-190)
National Historic Preservation Act of 1966, as amended (Public Law 89-665)
Noise Control Act of 1972, as amended
Occupational Safety and Health Act of 1970 (Public Law 91-956, as amended)
Resource Conservation and Recovery Act (Public Law 94-580)
Rivers and Harbors Act of 1899
Safe Drinking Water Act, as amended (Public Law 93-523)
Solid Waste Disposal Act of 1965, as amended
Surface Mining Control and Reclamation Act of 1977, as amended
Toxic Substances Control Act of 1976 (Public Law 94-469)
Watershed Protection and Flood Prevention Act of 1954 (16 U.S.C. 1101, et seq.)
Wetlands Conservation Act (Public Law 101-233)
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Floodplain Management (Executive Order 11988)
Protection of Wetlands (Executive Order 11990)
Federal Compliance with Pollution Standards (Executive Order 12088)
Environmental Justice in Minority Populations and Low-Income Populations (Executive Order 12898)

1. PURPOSE AND NEED

1.1 Purpose

The Tennessee Valley Authority (TVA) and the U.S. Army Corps of Engineers (COE) cooperated to prepare this Environmental Impact Statement (EIS). The purpose of this EIS is to evaluate the environmental impacts of the proposed purchase by TVA of electricity generated by the Red Hills Power Project (RHPP) and the permitting of the project by the COE.

The RHPP would consist of a surface lignite mine and a lignite-fueled generation facility near the Town of Ackerman in Choctaw County, Mississippi (Figure 1.1-1). Associated project components include water supply and disposal systems, a natural gas supply pipeline, and transmission line connections. Choctaw County and the state of Mississippi also propose to develop the Red Hills EcoPlex industrial park near to the proposed generation facility. Although the EcoPlex is not part of the actions under consideration by TVA and COE, potential cumulative impacts resulting from development of the EcoPlex are assessed.

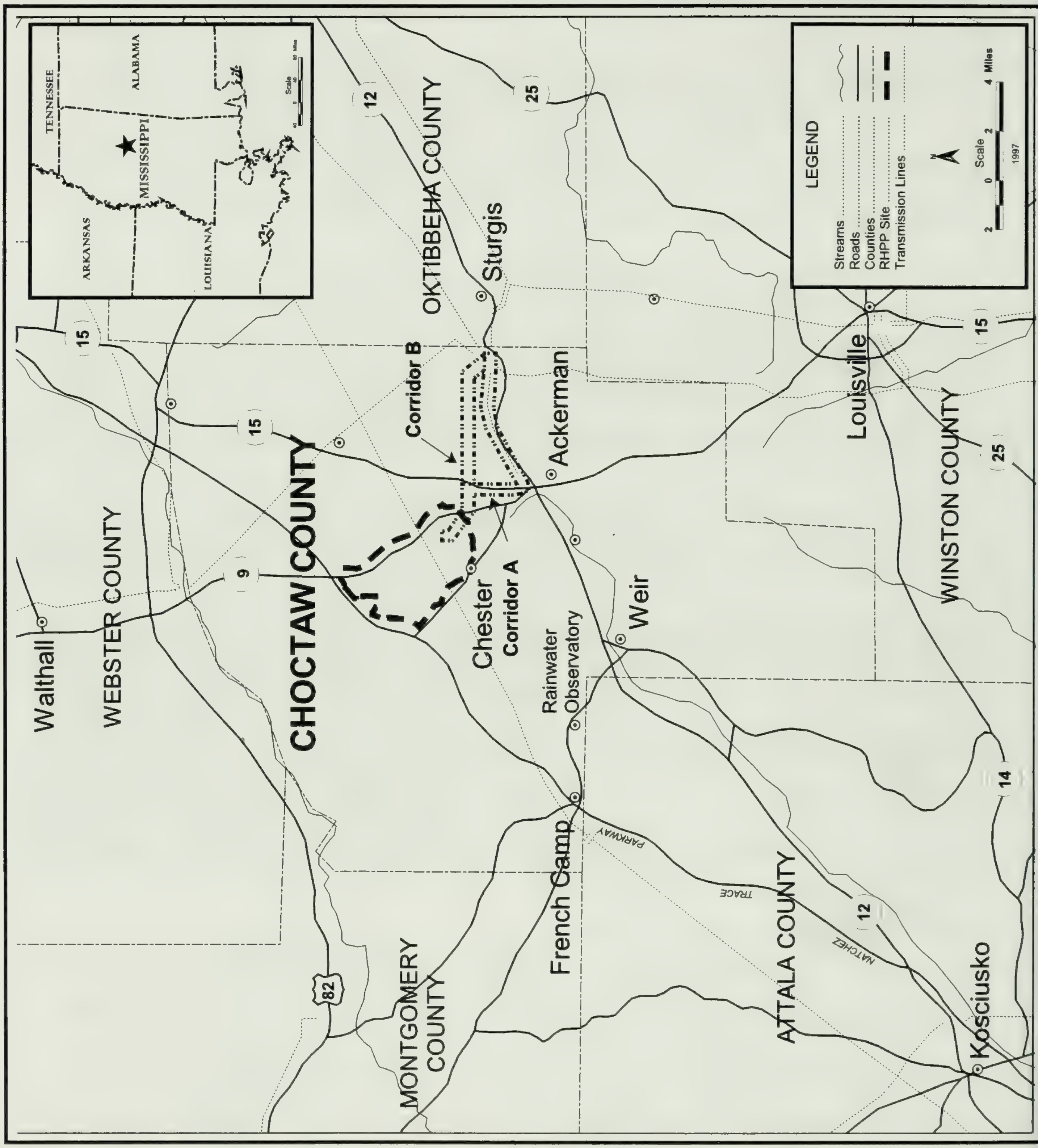
The purpose of TVA's proposed action–the purchase of electricity generated by the RHPP–is to provide a source of power to meet the growing demand for power by electricity users in the TVA region. The purpose of COE's action is to respond to requests for its approval.

1.2 The TVA Power System

TVA was established by an Act of Congress in 1933 as a federal corporation to develop the natural resources of the Tennessee Valley region and to improve the lives of the region's population. From its beginning, TVA's challenge has been to look at economic development and natural resource issues in a comprehensive fashion. TVA has also been expected to demonstrate the unique strengths of "a corporation vested with the power of government but with the flexibility and initiative of a private enterprise" (Lilienthal 1944). TVA is managed by a three-member Board of Directors appointed by the U.S. President and approved by the U.S. Senate.

Within a few years of its establishment, TVA had built a series of multipurpose dams on the Tennessee River system. One of the byproducts of these dams was abundant, inexpensive electricity. The hydroelectric power generated by these dams met most of the rapidly increasing needs of the region through the 1940s. By the early 1950s, however, the growing demand was quickly outstripping the capacity of the dams and Watts Bar Fossil Fuel Plant, which TVA completed in 1945. During the next 20 years, TVA built 11 large coal-fired generating plants to meet the region's growing needs. Some of these plants were the largest, first-of-their-kind, coal-fired units in the world. The 1960s brought even

Figure 1.1-1 Project area map.



greater growth to the region. To meet the anticipated need for more power, TVA began an ambitious program of nuclear plant construction.

Despite this growth program, TVA's electric rates remained among the lowest in the nation throughout the 1960s. However, the 1970s, beginning with the 1973 oil embargo, brought unprecedented change to the entire electric utility industry's ability to control costs and rates charged to customers. Coal costs and the costs of constructing nuclear units rapidly increased, forcing TVA and most other electric utilities to increase their rates. As energy costs across the nation continued to climb in the late 1970s and early 1980s, TVA introduced aggressive programs to encourage customers to reduce their demand for electricity. These programs, focusing on energy conservation and reducing peak electric loads, worked in concert with TVA's existing generating resources to meet consumer energy needs.

Today, TVA is one of the largest producers of electricity in the United States, generating four to five percent of all electricity in the nation. TVA's power system serves almost eight million people in a seven-state region encompassing some 80,000 square miles (Figure 1.2-1). TVA's electricity is distributed to homes and businesses through a network of 159 power distributors, including municipally owned utilities and electric cooperatives. TVA also sells power directly to approximately 60 large industrial customers and federal facilities.

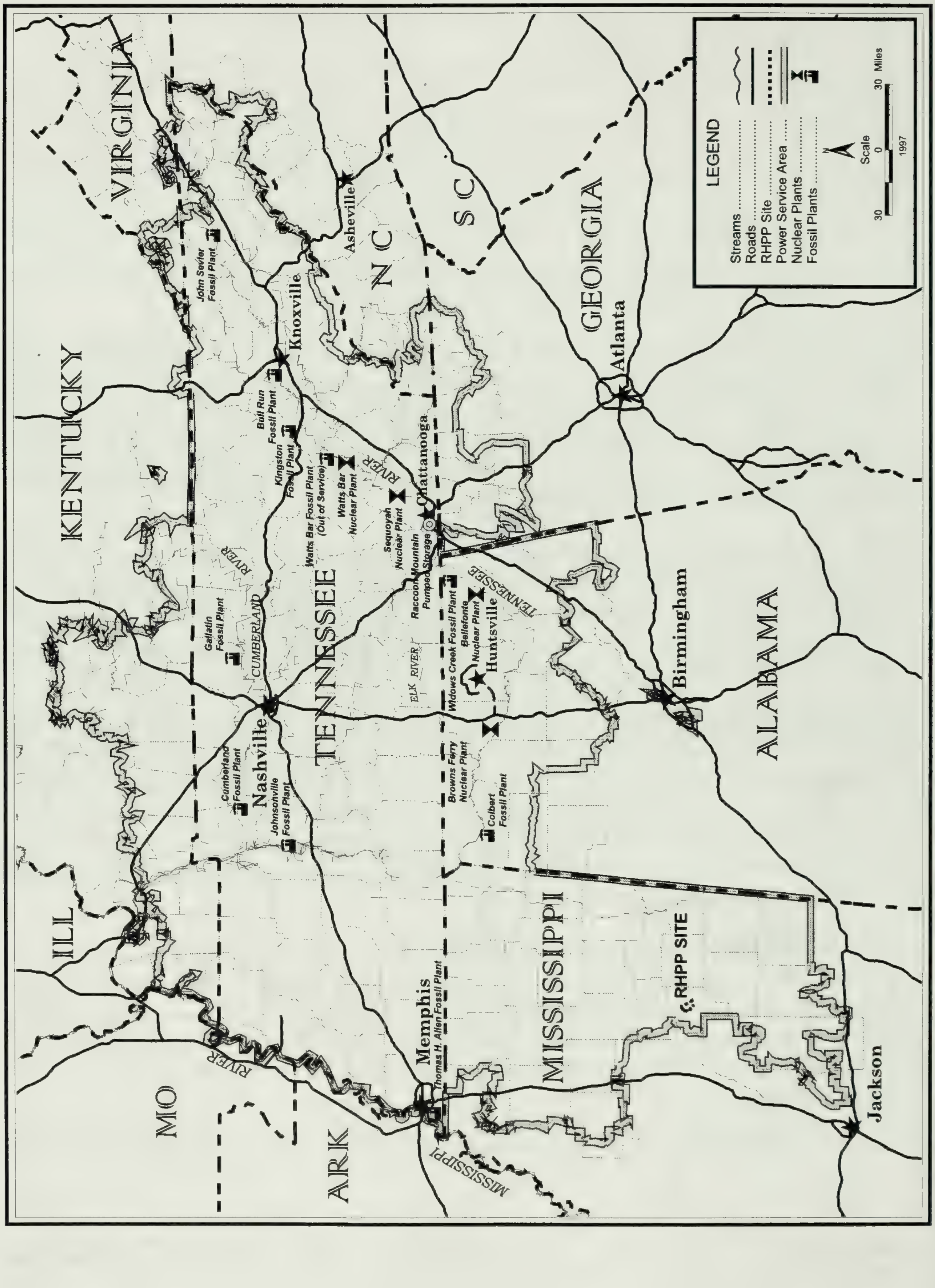
TVA's power system, which is self-financed, has a generating capacity of 28,000 MW. Its generating system consists of 11 coal-fired plants (53% of total generating capacity), 5 nuclear generating units at 3 sites (20%), 29 hydroelectric dams (15%), 48 combustion turbine units at 4 sites (7%), and 1 pumped-storage facility (5%) (Figure 1.2-1). The system is linked by 16,000 miles of transmission lines that carry power to 750 wholesale delivery points, as well as 57 interconnections with 13 neighboring utilities.

1.3 Need for Power

Under the National Energy Policy Act of 1992 (PL 102-486), TVA was directed to employ a least-cost energy planning process for the addition of new energy resources to its power system. In response to this directive, TVA began work on an Integrated Resource Plan (IRP) in February 1994. An IRP is a plan that broadly identifies the actions that a utility anticipates taking to meet demands for electric service and to achieve its long-term goals and objectives.

TVA completed this planning process in December 1995 with the publication of *Energy Vision 2020-Integrated Resource Plan/Environmental Impact Statement* (TVA 1995). This document projected demands for electricity in the TVA power service area through the year 2020 and evaluated different ways of meeting these projected increases. Under the medium load forecast, the demand for electricity was projected to exceed TVA's 1996 generating capacity of 28,000 MW by 800 MW in 1998, and by 6,250 MW in 2005.

Figure 1.2-1 TVA power service area and TVA generating system.



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

1.3.1 The Energy Vision 2020 Planning Process

Because the projected demand for electricity exceeds TVA's current generating capacity, much of *Energy Vision 2020* is an evaluation of ways to meet that demand. This evaluation used the best industry practices in integrated resource planning and included multiple evaluation criteria, consideration of future uncertainties, and extensive public input. The evaluation criteria used to compare energy resource strategies included:

- Long-Run Cost and Value Criteria,
- Short- and Mid-Term Rates,
- Reliability,
- Environmental Impacts,
- Economic Development,
- Financial Requirements,
- Risk Management, and
- Equity Among Rate Classes.

These criteria and their associated measures became the basis for ranking a large number of supply-side and customer service options. They were later used in an analysis to evaluate and improve TVA's strategies. The results of this analysis showed that customer service options, such as demand-side management and rate restructuring, were not, by themselves, adequate to meet the projected electrical demand increases.

The evaluation of supply-side options considered numerous methods of generating electricity, including traditional technologies (e.g., coal plants, combustion turbines), as well as potential renewable and advanced combustion facilities. TVA also evaluated options that would give greater flexibility in planning. These options included purchasing competitively-priced power from other suppliers (e.g., independent power producers, cogenerators), buying options on future power delivery (option purchase agreements), and entering business partnering arrangements. Overall, TVA characterized and evaluated over 100 supply-side options.

The resulting recommendations of *Energy Vision 2020*, which were adopted by the TVA Board of Directors in February 1996 (TVA 1996a), included the following long-term components:

- supply-side options, including combustion turbines, purchasing and exercising call options for both base load and peaking power, purchasing power from independent power producers, developing renewable energy resources, improving the existing hydroelectric generating system, and converting Bellefonte Nuclear Plant to an alternative fuel source such as natural gas or gasified coal;
- customer service options, including demand-side management and beneficial electrification, for up to 2,200 MW; and
- environmental control options, including fuel switching and increased use of scrubbers at coal-fired plants.

The short-term supply-side action plan, to meet demand through the year 2002, includes most of the supply-side options listed in the long-term plan, along with targeted capacities and completion dates (e.g., implement up to 3,000 MW of purchase call options by 2002), and a requirement to begin the development of additional power generating and storage capacity.

1.3.2 The RHPP Proposal

In 1993, TVA first received a proposal from Phillips Coal Company (PCC) and Tractebel Power, Inc. (TPI, then known as CRSS Inc.) for the purchase of electricity from a lignite-fueled generation facility in Choctaw County, Mississippi. At that time, the projected cost of the electricity from this facility was not competitive with other sources available to TVA. This was confirmed by the analysis of generic lignite plants done for TVA's *Energy Vision 2020 EIS*. Two of the supply-side options evaluated in *Energy Vision 2020* were a 200-MW lignite-fueled circulating fluidized bed (CFB) combustion plant built by TVA and a 300-MW lignite-fueled CFB combustion plant built and operated by an independent power producer. When compared to other supply-side options, neither of these lignite plant options proved to be cost-competitive.

Subsequent to release of the *Energy Vision 2020 EIS*, TPI and PCC refined their cost estimates and a lignite-fueled project was formulated that was competitive with other long-term projects studied in *Energy Vision 2020*. There was also widespread public and political support for the proposed project.

The RHPP, as proposed, would consist of a lignite-fueled generation facility producing 440 MW of electricity. The lignite would be mined, at the rate of about three million tons per year, from an adjacent 5,800-acre surface mine area. Construction would begin in late 1998, and lignite mining and power generation would begin during the second half of the year 2000.

1.4 Decisions to be Made

The federal agencies involved in the preparation of this EIS are TVA and COE.

TVA must decide whether to commit to purchasing the electricity generated by the RHPP. If the decision is made to purchase the electricity, TVA must also decide how to connect the generation facility to its existing electrical distribution system.

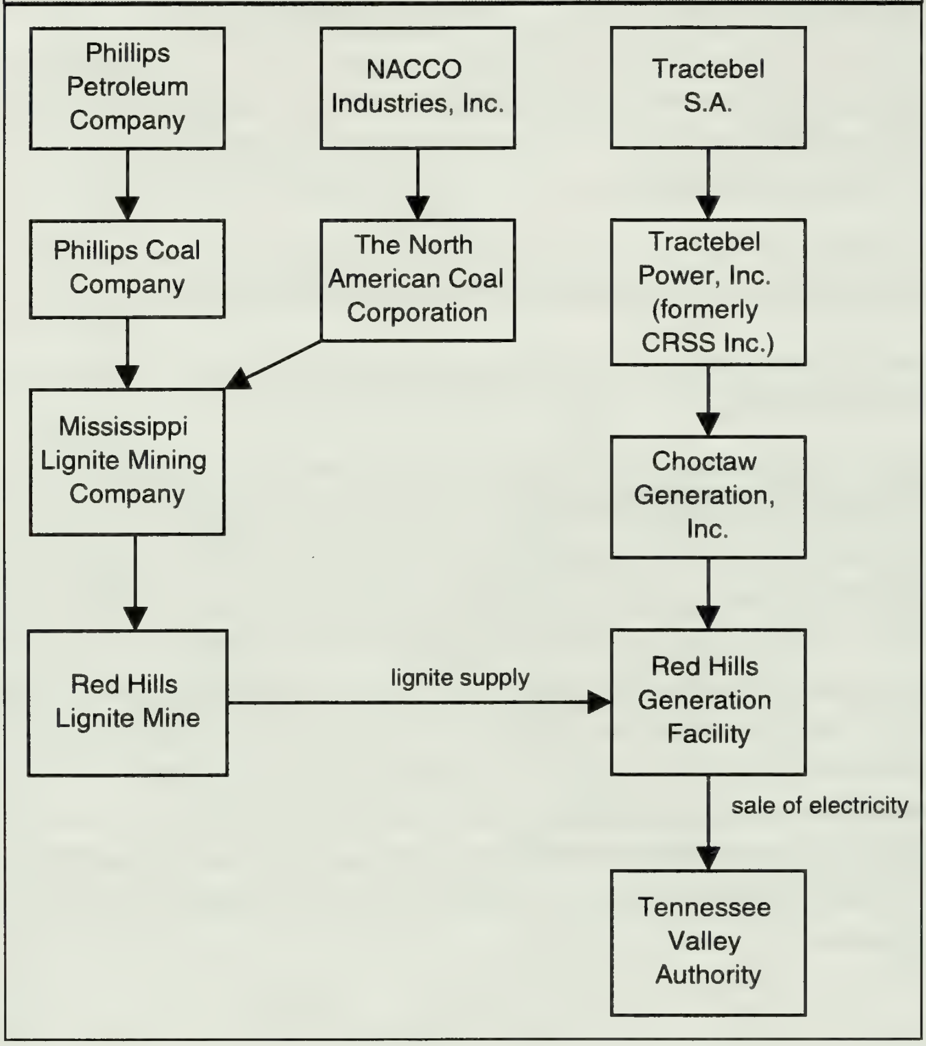
COE must decide whether to issue permits for impacts to wetlands and other waters of the U.S. resulting from construction and operation of the generation facility, mine, and related project components.

Other federal, state, and/or local agencies must also decide whether to issue the necessary operating and construction permits and approvals for this project.

1.5 Description of the Applicant

The RHPP consists of the Red Hills Generation Facility (RHGF), the Red Hills Lignite Mine (RHLM), and associated project components. An organization chart of the RHPP is shown in Figure 1.5-1. The proposed generation facility would be owned and operated by Choctaw Generation, Inc. (CGI), headquartered in Ackerman, Mississippi. CGI is a subsidiary of Tractebel Power, Inc. (TPI, formerly known as CRSS Inc.), which is based in Houston, Texas. TPI is a wholly owned subsidiary of Tractebel S.A., which is headquartered in Brussels, Belgium. The proposed mine would be owned and operated by Mississippi Lignite Mining Company (MLMC), a joint venture of PCC and The North American Coal Corporation (NAC), with headquarters in Ackerman, Mississippi. A subsidiary of Phillips Petroleum Company, PCC has headquarters in Richardson, Texas. NAC, based in Dallas, Texas, is a subsidiary of NACCO Industries, Inc.

Figure 1.5-1 RHPP organization chart.



1.6 The EIS Process

The National Environmental Policy Act (NEPA) of 1969 and its implementing regulations require federal agencies to make available "environmental" information about actions they propose to take [see 40 CFR §1500.1(b)]. The purpose for this is to allow agency decision makers and the public to make well-informed decisions about the merits of proposed actions. An EIS is one means of providing information to help weigh the potential benefits of a proposed action against the action's potential impacts on the environment.

NEPA requires the preparation of an EIS for major federal actions significantly affecting the environment. In addition, TVA's NEPA procedures (TVA 1983) normally require preparation of an EIS for major power plant projects or mines. Although TVA itself would not be the entity that develops and operates the proposed RHPP, its decision to purchase power from the project would indirectly result in the impacts associated with the project.

The EIS process is designed to provide the public an opportunity to comment on proposed major federal actions, to disclose the potential anticipated environmental impacts of actions to federal decision makers and the public, and ultimately, to make decisions which take into account potential environmental impacts. NEPA does not, however, require that environmentally-preferable courses of actions be pursued.

Measures to involve the public in this EIS process include publishing a Notice of Intent (NOI) to prepare the EIS (Appendix A-1), advertising and holding a public scoping meeting (Section 1.7) (Appendix A-2), distributing the Draft EIS (DEIS) to the public, holding a public meeting to receive comments on the DEIS, soliciting written comments on the DEIS, and responding to these comments during preparation of the Final EIS (FEIS).

1.7 The Scoping Process

Public participation in determining the scope of this EIS began on October 16, 1996, when TVA published a NOI in the *Federal Register* (TVA 1996b). In this notice, TVA announced its intention to prepare this EIS and invited comments on the scope of the evaluation. The NOI contained brief descriptions of TVA's proposed actions, the proposed generation facility, mine, and transmission line connections, as well as a discussion of alternatives and an initial list of issues likely to be addressed. The NOI also disclosed the state's plan to build an EcoPlex industrial park adjacent to the proposed project. The NOI announced that a public meeting would be held on October 29, 1996, at Ackerman High School, near the project site, in order to receive oral comments and that written comments should be submitted by November 15, 1996.

Concurrently with the publication of the NOI, the scoping meeting and comment period were announced in direct mailings to over 200 local residents, elected officials, and government agencies. TVA also published notices of the public meeting in five weekly and two daily local newspapers, and issued a press release describing the public meeting.

Over 250 people attended the October 29, 1996, public meeting. Attendees were given an information packet briefly describing the project. Representatives of TPI, PCC, and TVA gave presentations on the generation facility, the mine, and the EIS process. The attendees were then invited to provide comments in one of five breakout sessions, where facilitators recorded oral comments on flipchart pages. Written comments were also accepted at the meeting and through the mail. Written comments were received from five individuals, three organizations, the U.S. Fish and Wildlife Service (FWS), and the National Park Service (NPS).

The major themes and issues presented at the public meeting and in letters were summarized in a scoping document. Copies of the scoping document were distributed to scoping participants and other interested parties on February 14, 1997.

Most of the comments received at the scoping meeting and in letters fell into two major categories:

- the need for basic information about the project, such as the location of the various project components and a description of the mine reclamation; and
- the effects of the project on various environmental and socioeconomic resources.

Other comments addressed the need for electric power, why TVA is proposing to purchase electricity from the RHPP instead of from other suppliers, the financial feasibility of the project, public communications, and coordination between the various parties involved in the project.

1.8 Issues to be Addressed in Detail

The following issues, identified during the external and internal scoping process and in discussions among TVA, TPI, and PCC staff, will be addressed in detail in this EIS.

Air Resources – The project would be a new major source of air emissions as defined by the Clean Air Act (CAA) and its amendments. Potentially-affected air resources include ambient air quality and visibility.

Water Resources – The project would use groundwater for generation facility cooling as well as for other purposes. It could affect the quantity and quality of groundwater resources, both deep and shallow, as well as the quantity and quality of surface water resources, including local streams, springs, and ponds.

Aquatic Life – Impacts to streams, springs, and ponds resulting from construction and operation of the various project components could affect the aquatic life, such as fish, aquatic insects, snails, and mussels, that inhabit those water bodies.

Geology and Soils – The geology and soils in the project area are critical considerations in siting and operating the generation facility, mine, and other project components. Of these project components, the operation of the mine would have the greatest potential to affect local geology and soils. Soil characteristics would also influence mine reclamation plans.

Terrestrial Life – Construction and operation of the generation facility, mine, and other project components could impact game and nongame wildlife populations and the plant communities on which they depend.

Threatened or Endangered Species – TVA and COE, like other federal agencies, are required to address the potential impacts of its actions on threatened or endangered species.

Wetlands - TVA and COE are also required to consider potential impacts on existing wetlands that would likely be affected by construction and operation of the generation facility, mine, and other project components. Operation and reclamation of the mine also would likely result in construction of additional wetlands.

Land Use – Construction and operation of the generation facility, mine, and other project components would likely result in both short- and long-term changes to existing land uses in the project area.

Recreation – The site of the proposed project receives some hunting and other recreational use, and is adjacent to the Natchez Trace Parkway, Jeff Busby developed area, and Little Mountain Overlook. Recreational uses of these areas could be affected by project activities.

Archaeological and Historic Resources – The project area may contain prehistoric and historic cultural resources that could be affected by the proposed actions.

Transportation – Construction and operation of the project could result in increases in road and rail traffic and require improvements to existing transportation routes and construction of new transportation routes.

Socioeconomics – The proposed project would result in many new jobs in the project area and could affect property values. Consequences could include migration to the area, increases in tax revenues, and increased demands for schools, medical facilities, housing, and other services. The potential to disproportionately affect minority, low income, and/or aged populations is also addressed under environmental justice.

Noise – The construction and operation of the generation facility, mine, and other project components would change the ambient noise levels in the project area.

Aesthetics and Scenic Views – The proposed activities would result in both short- and long-term changes in local scenery and could affect views from the Natchez Trace Parkway, Jeff Busby developed area, and Little Mountain Overlook, as well as the clarity of the night sky.

Public Health and Safety – The construction and operation of the generation facility, mine, and other project components could affect public health and safety through air emissions, hazardous and non-hazardous waste, wastewater discharges, electric and magnetic fields, radiation, and road and railroad traffic.

1.9 Issues Determined to be Out of Scope

A number of subjects or issues were identified during the scoping process that have been determined to be out of scope or not otherwise appropriate for this EIS. All of these either involve nonenvironmental details (such as legal details in possible power purchase agreements that are commercially sensitive) or are issues evaluated in TVA's *Energy Vision 2020 EIS* from which this EIS is tiered (see 40 CFR §1502.20). These issues include:

- contractual terms under which TVA would purchase power from CGI;
- cost of power from other possible energy sources;
- return on investment in the project to MLMC and CGI;
- terms of the lignite lease contracts and specifics about royalty payments (general information about royalty payments and remediation requirements of lease contracts will be presented); and
- details about the proposed funding of the State's Red Hills EcoPlex industrial park.

1.10 Permitting Requirements

Many activities described in this EIS would require review and consultation with other federal and state agencies. Several activities would also require permits or approvals from federal, state, or local agencies. Environmental permitting processes help prevent unacceptable environmental impacts and safeguard important environmental resources. Table 1.10-1 lists relevant statutes and Executive Orders. These permitting, review, and consultation requirements are summarized below for each resource area.

Air Quality – Components of the project would require air emissions permits from the Mississippi Office of Pollution Control (MOPC). Applications for these permits would be reviewed for compliance with the National Ambient Air Quality Standards (NAAQS), the Prevention of Significant Deterioration (PSD) of Air Quality, New Source Performance Standards (NSPS), and National Emission Standards for Hazardous Air Pollutants (NESHAPS).

Water Quality and Use – Potential impacts to wetlands and other waters of the U.S. will be reviewed by the COE under the authority of Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899. Individual and/or nationwide 404 permits would be required for some project activities. Issuance of these permits would also require State Water Quality Certification from MOPC.

Table 1.10-1 Relevant Environmental Authorities
Statute
Archaeological and Historic Preservation Act of 1974 (16 U.S.C 469)
Clean Air Act, as amended (Public Law 88-206)
Clean Water Act, as amended (Public Law 95-217)
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Public Law 96-510), as amended by the Superfund Amendments and Reauthorization Act of 1986 (Public Law 99-499)
Emergency Planning and Community Right-to-Know Act of 1986 (42 USC 11001 et seq.)
Endangered Species Act of 1973, as amended (Public Law 93-205)
Farmland Protection Policy Act of 1984 (7 U.S.C. 1539-1579)
Federal Aviation Act (49 U.S.C. 1304 et seq.)
Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661, et seq.)
Mine Safety and Health Act (Public Law 910173 as amended by P.L. 95-164)
Mississippi Solid Waste Act (Mississippi Code, 1972, Sections 17-17-1 et seq., as amended)
Mississippi Water Rights Act (Mississippi Code, 1972, Section 51-3-1 et seq., as amended)
Mississippi Water Laws (Mississippi Code, 1972, Section 51-3-39 et seq., as amended April 1, 1985)
Mississippi Surface Coal Mining and Reclamation Law, Section 53-9-1, et seq., as amended
National Environmental Policy Act of 1969 (Public Law 91-190)
National Historic Preservation Act of 1966, as amended (Public Law 89-665)
Noise Control Act of 1972, as amended
Occupational Safety and Health Act of 1970 (Public Law 91-956, as amended)
Resource Conservation and Recovery Act (Public Law 94-580)
Rivers and Harbors Act of 1899
Safe Drinking Water Act, as amended (Public Law 93-523)
Solid Waste Disposal Act of 1965, as amended
Surface Mining Control and Reclamation Act of 1977, as amended
Toxic Substances Control Act of 1976 (Public Law 94-469)
Watershed Protection and Flood Prevention Act of 1954 (16 U.S.C. 1101, et seq.)
Wetlands Conservation Act (Public Law 101-233)
Executive Order
Floodplain Management (Executive Order 11988)
Protection of Wetlands (Executive Order 11990)
Federal Compliance with Pollution Standards (Executive Order 12088)
Environmental Justice in Minority Populations and Low-Income Populations (Executive Order 12898)

Project construction activities, the generation facility, and the mine would require Storm Water Discharge Permits issued by the MDEQ Permit Board as part of the National Pollutant Discharge Elimination System (NPDES) and construction permits for septic tanks from the Department of Health. The generation facility would not have discharges for wastewater or treated sanitary wastewater requiring NPDES permits. The mine would require an NPDES permit for the mine discharges and a wastewater treatment package plant.

The use or impoundment of surface water, as well as use of groundwater pumped from a well with a casing six inches or more in diameter, would require a Surface Water or Groundwater Use Permit issued by the MDEQ Permit Board.

The generation facility and mine would be required to have Spill Prevention Control and Countermeasure (SPCC) Plans and Facility Response Plans in place to address potential contamination from fuel oil and chemical storage facilities.

The construction of dams for sedimentation ponds and emergency generating facility cooling water storage would require authorization from the Mississippi Office of Land and Water Resources (MOLWR) if the dams meet minimum height or storage requirements, or are located on perennial streams. Dams within the mine area meeting these criteria would also require MSHA permits approval.

Land Use – Under the Farmland Protection Policy Act, potential impacts to prime farmland must be reviewed.

Floodplains – Potential impacts to floodplains are evaluated under Executive Order 11988 on floodplain management. Choctaw County does not participate in the National Flood Insurance Program and, therefore, no locally-issued development permits certifying compliance with floodplain regulations would be required.

Biological Resources – If the agencies' analysis shows that threatened or endangered species may be adversely affected by project activities, consultation would be required with FWS under Section 7 of the Endangered Species Act (ESA). The COE also must comply with the Fish and Wildlife Coordination Act in its permitting activities.

Cultural Resources – The National Historic Preservation Act (NHPA) of 1966 and the Archaeological Resources Protection Act (ARPA) of 1979 require federal agencies to address by avoidance or mitigation qualifying archaeological and historic sites which may be affected by their actions. Impacts on these resources will be reviewed by the Mississippi State Historic Preservation Officer (SHPO). A Programmatic Agreement with the SHPO and the Advisory Council on Historic preservation would be executed for compliance with Section 106 of the NHPA.

Noise – No noise-related permits are required. However, project activities will be evaluated against relevant Environmental Protection Agency (EPA), U.S. Department of Housing and Urban Development (HUD), and Occupational Safety and Health Administration (OSHA) noise guidelines and requirements.

Solid and Hazardous Waste Disposal – The proposed onsite ash management unit would require a Special/Industrial Solid Waste Permit issued by MDEQ. Land clearing operations associated with mining would produce stumps, slash, and nonhazardous demolition debris. MLMC proposes to dispose of this inert material onsite in mine pits and has applied for an exemption from the requirement for a State solid waste management facility operating permit from MDEQ. Both the generation facility and

mine are anticipated to qualify as Conditionally Exempt Small Quantity Generator or Small Quantity Generator of hazardous waste.

Health and Safety – Although most health and safety related issues do not require permits, project activities must meet federal and/or state standards for emergency planning, public reporting of certain hazardous and toxic substances, and workplace safety. The Occupational Safety and Health Administration oversees and enforces the safety and health elements of the generation facility and its related project components, such as the transmission line and natural gas pipeline. The Mine Safety and Health Administration oversees and enforces the safety and health elements of the mine.

Air Navigation – Because of the height of the proposed generation facility stack, the Federal Aviation Administration (FAA) would have to certify that the facility would not be hazardous to air navigation.

Environmental Justice – In order to comply with the Executive Order No. 12898 on environmental justice, certain federal agencies must show that project activities would not disproportionately impact minority and/or low income communities. Although these requirements do not apply to TVA, it considers such impacts as a matter of policy.

Surface Mining – Surface coal mining is regulated by the Office of Geology in the Mississippi Department of Environmental Quality (MDEQ) under the authority of the Mississippi Surface Mining and Reclamation Act of 1979, as amended, and the federal Surface Mining Control and Reclamation Act of 1977. Mining and reclamation activities would require a Surface Mining Permit. The mining permit would be issued for a term of five years, at which time a permit renewal would be required.

1.11 EIS Overview

This EIS follows a fairly standard format, consistent with NEPA and subsequent regulations published by the Council on Environmental Quality (CEQ 1992). Chapter 2 presents a description of the alternatives being evaluated in this EIS, as well as a summary of their environmental consequences, supplemented by Appendix B. Chapter 3 presents a description of the environmental features of the project area (supplemented by Appendix C), and Chapter 4 describes how these environmental features would be affected by each alternative (supplemented by Appendix D). Chapter 5 presents supporting information including a list of preparers of this EIS, and a list of references used in this evaluation. The appendices present additional detailed information. Chapter 6 contains the distribution list for the EIS. A glossary of important terms is also included.

2. ALTERNATIVES

The purpose of this chapter is to:

- describe the alternative actions–the proposed actions and no action;
- describe the facilities which would be constructed and operated as a consequence of the proposed actions;
- summarize the environmental consequences of the alternative actions; and
- describe the Red Hills EcoPlex industrial park being developed by Choctaw County and the state of Mississippi in the vicinity of the proposed Red Hills Power Project.

2.1 No Action

Under the No Action Alternative, the Tennessee Valley Authority (TVA) would not purchase electrical power generated by the project. TVA would also not construct a transmission line connecting the generation facility to the TVA power distribution system. Any environmental impacts associated with TVA's purchase of this electrical power from the project would not occur. In order to meet its anticipated power demands, TVA would consider other energy resource options assessed in *Energy Vision 2020* (TVA 1995). However, TVA's decision not to purchase electricity from this project would not preclude development of the generation facility and/or mine. If TVA does not buy the power, the energy developed through this project could be sold to another purchaser and lignite could still be mined. Thus, the potential impacts identified in the Action Alternative would not necessarily be avoided. The COE's No Action Alternative would be to not issue requested permits.

2.2 Proposed Actions and Alternative Components

TVA's proposed actions are to purchase the electricity generated by the RHPP and to construct a new transmission line connecting the generation facility to TVA's electrical distribution system. The purchase of electricity by TVA would result in the construction and operation of both the Red Hills Generation Facility (RHGF) and the Red Hills Lignite Mine (RHLM), as well as the environmental impacts associated with these activities.

The principal parties involved in the RHPP–Choctaw Generation, Inc. (CGI) and Mississippi Lignite Mining Company (MLMC) (Figure 1.5-1)–are essentially private applicants seeking TVA's and COE's approval. (This is a commonly encountered situation in NEPA review.) As such, CGI and MLMC are responsible for the design of various project components and the siting of those components. TVA has little or no control over project-related decisions made or proposed by CGI or MLMC. Its control is largely limited to deciding whether to purchase power from the proposed facility and deciding how to connect the facility to the TVA power distribution system. Some of the project components fall under COE's regulatory jurisdiction for wetlands and other waters of the U.S. The COE could require that certain potential impacts be avoided or mitigated through Section 404 of the Clean Water Act.

The project components, including siting, are described in detail in the following subsections of this EIS. The subsections also include descriptions of alternative components evaluated and rejected by CGI and/or MLMC. Although TVA's control is limited, it has reviewed the applicants' proposals, as described below. None of the choices rejected by the applicants appear to be environmentally advantageous and still meet the objectives of the applicants.

2.2.1 Generation Facility

2.2.1.1 Generation Facility Location

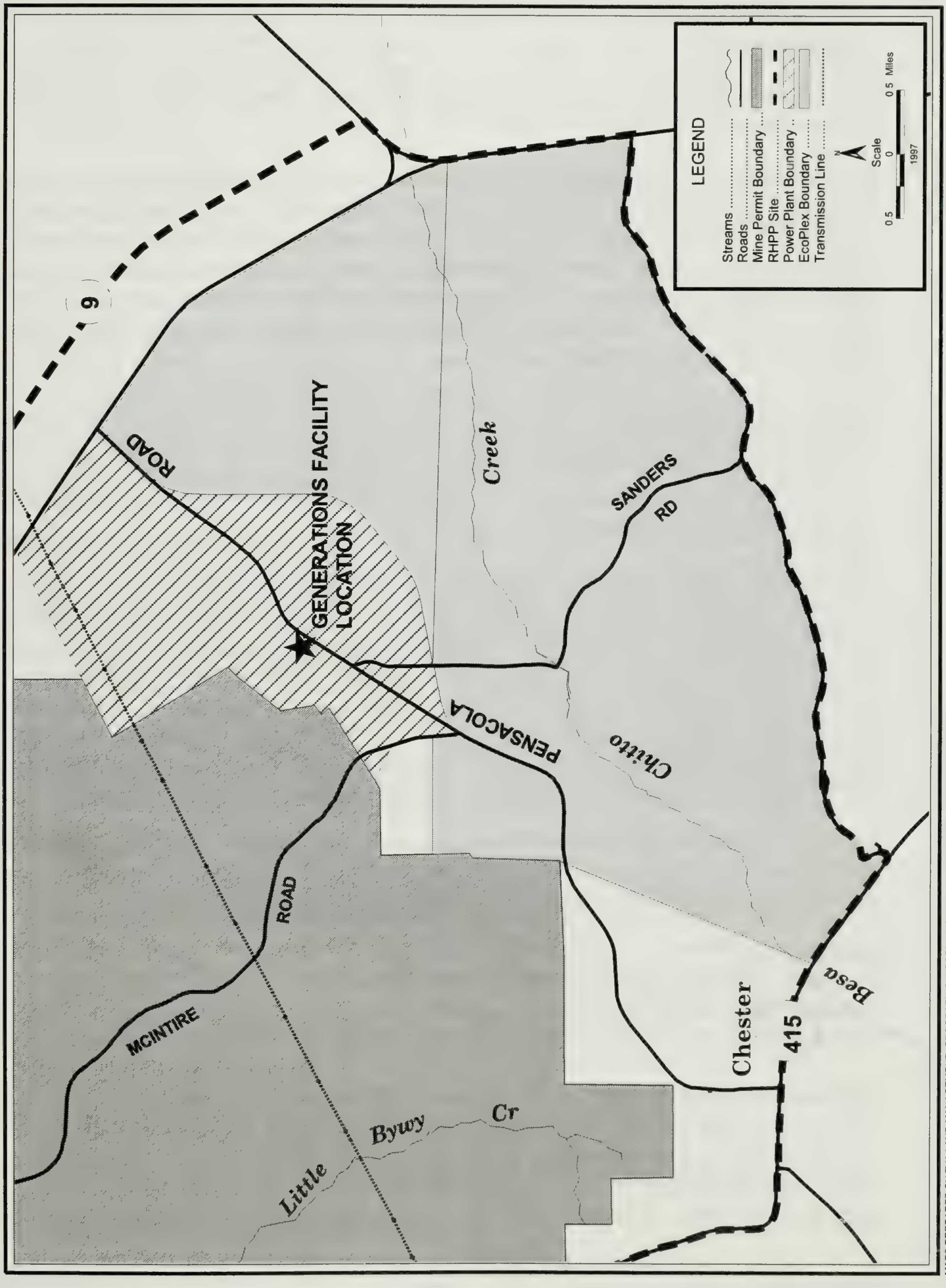
The generation facility would require about 170 acres for their facilities, as well as additional area for ash management and site buffers. Because of the costs of transporting lignite, the general location of the proposed generation facility would be dictated by the location of the lignite mine, as described in Section 2.2.2.1. Other factors initially considered in selecting potential facility locations included the following:

- absence of economically-recoverable lignite reserves under the facility location;
- physical boundaries formed by the Natchez Trace Parkway, Highway 15, and the 500-kV transmission line; and
- proximity to the planned EcoPlex industrial park.

Based on these constraints, potential sites were located south of the 500-kV transmission line, northeast of the Town of Chester, and west of Highway 15. CGI evaluated these potential sites for many cost and environmental criteria including site clearing and grading; proximity to the lignite mine, potential ash management areas, transportation facilities, utilities, electrical transmission system connections, the EcoPlex, populated areas, and parks; number of landowners; soil conditions; presence of wetlands, archaeological sites, historical sites, and floodplains; and visibility from the Parkway's Little Mountain Overlook. As a result of this analysis, CGI selected the facility site shown on Figure 2.2.1.1-1. All of the other sites evaluated were within 1.3 miles of this site, had higher associated costs, and had no clear advantage with respect to environmental impacts. TVA has reviewed the CGI site selection process and thinks it was appropriate. As a result, no other potential facility locations are considered in this EIS.

The proposed generation facility site occupies about 390 acres. About 170 acres of the site would be occupied by their facilities, and 150 acres would be used for an ash management unit. The remaining acreage would be used for buffer areas.

Figure 2.2.1.1-1 Generation facility location.



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

2.2.1.2 Generation Facility Operations Alternatives

Combustion Boiler

Two types of combustion boilers capable of burning lignite were considered by CGI: (1) pulverized coal (PC) and (2) circulating fluidized bed (CFB).

Pulverized Coal – PC boilers are a commercially mature technology with high boiler heat efficiency. PC boilers have limited flexibility in handling fuels with varying volatiles content, surface moisture, and heating value. A power plant with PC boilers would require wet scrubbers for reduction of SO_2 emissions, and consequently produce large volumes of scrubber sludge that would likely have to be disposed of onsite. PC boilers would also require a sophisticated NOx emissions control system. Overall efficiency with PC boilers would be decreased because of power requirements to dry the high-moisture lignite fuel and to operate the emission controls.

Circulating Fluidized Bed – In a CFB combustion system, lignite and limestone are both injected into the combustion chamber, where they are burned in a "bed" held in a fluid state by upward jets of hot air. The calcium in the limestone combines with sulfur gases emitted by the burning lignite resulting in an ash that contains the sulfur compounds. This results in the elimination of most SO_2 emissions without the need for wet flue-gas scrubbers.

CFB technology, while younger than PC technology, is commercially mature and represents a "clean coal technology" as defined by the Department of Energy (DOE 1997). CFB boilers equivalent to those that would be required for the Red Hills Generation Facility are presently operating. Compared to PC boilers, the overall efficiency of a generating station with CFB boilers is slightly higher because fuel drying and scrubbers are not needed. CFB boilers offer high flexibility in handling fuels of varying volatiles content, surface moisture, and heating content. Because of their relatively low combustion temperature (815 to 925°C), NOx emissions and ash deposits and slagging within the boiler are low compared to PC boilers. SO_2 emissions from the CFB boilers are comparable to those from PC units with wet scrubbers.

Because of the more efficient NOx and SO_2 removal, greater fuel flexibility, more efficient handling of high-moisture fuels, high overall efficiency inherent in CFB boilers, and their resultant lower overall operating costs, CGI has chosen CFB boilers for use at the Red Hills Generation Facility.

Cooling System

Three potential cooling systems were evaluated by CGI for use at the generation facility: (1) a dry mechanical draft condenser; (2) a once-through direct water cooling system; and (3) a wet mechanical draft cooling tower.

Dry Mechanical Draft Condenser – A dry mechanical draft condenser is a closed-cycle system where turbine exhaust steam is condensed in a large air-cooled heat exchanger. Large fans are used to increase air movement through the condenser. No water would be required for cooling, although other generation facility processes would require two to three acre-feet of water per MW per year. This system has high operating costs because of its high turbine backpressure and resulting poor efficiency during warm

weather. Annual operating costs of a dry mechanical draft condenser for the generation facility would be about $19 million more than direct water cooling. Initial construction costs would be about 2.5 times more than for a wet mechanical draft cooling tower and much less than one-third the cost of direct water cooling. Because of the costs and relatively low efficiency of this system, CGI rejected it for use at the generation facility.

Once-Through Direct Water Cooling – This system operates by continuously pumping water from a river, lake, or pond through the steam condenser, and then discharging the heated water back into the water body. Annual water requirements would be about nine to ten acre-feet per MW. Because there are no rivers with sufficient flow located near the proposed facility site, direct water cooling would require construction of a lake with a surface area of 400 to 500 acres and a piping system between the lake and the facility. Potential lake sites are at least six miles from the proposed facility. This system would have the lowest annual operating costs. Initial costs for construction of the lake and piping system would be at least $135 million. There also would be environmental impacts associated with constructing a lake that would have to be addressed. Use of once-through direct water cooling systems also is restricted by state of Mississippi regulations. Because of the high initial costs and difficulties in meeting regulations, CGI rejected the use of direct water cooling at the generation facility.

Wet Mechanical Draft Cooling Tower – This system pumps cooling water through the steam condenser, where it is heated, to the top of the cooling tower, where it then falls to the bottom of the tower to be collected and pumped back to the condenser. Large fans maintain a continuous upward draft through the tower, and the heated water is cooled by evaporation as it falls through the draft in the tower. A continuous source of additional water is needed to replace losses from evaporation. Because the evaporation causes a buildup of chemicals, which, if not controlled, would cause scale to form on the condenser tubes and decrease efficiency, additional water is needed to periodically replace or "blowdown" a portion of the cooling water and maintain low chemical concentrations. Annual water requirements would be about 11.5 ac-ft per MW. This system operates efficiently in a wide range of weather conditions and requires little land besides that occupied by the cooling tower, which in turn reduces potential land use impacts.

CGI has chosen the wet mechanical draft cooling tower system as the preferred method for generation facility cooling. This system would have the lowest initial costs ($15 million vs. $37 million for dry mechanical draft cooling and at least $135 million for direct cooling). Operating costs would be intermediate between those of dry mechanical draft and direct cooling. This system would not require construction of a lake and connecting pipelines, and thus would avoid their resulting environmental impacts. It would require the continuous supply of about 4,600 gpm (6.33 million gpd) of makeup water to replace evaporation and blowdown losses.

Water Supply System

The wet mechanical draft cooling tower system and other generation facility systems would require a continuous source of 4,600 gpm (6.33 million gpd) of raw process water. Potential sources of this water are (1) surface water and (2) groundwater.

Surface Water – As described above, under the evaluation of the once-through direct water cooling system, no water bodies of sufficient size to meet the water needs of the proposed generation facility presently exist. Because of the costs, effect on the environment, impact on surface ownership, and time requirements for constructing a lake capable of meeting anticipated facility needs, CGI rejected the use of a surface water source.

Groundwater – The potential of groundwater aquifers at different depths to meet the raw water supply needs was evaluated on the basis of aquifer depth, recharge rate, and water quality. Based on available groundwater information, as well as results from test wells, CGI proposes to supply the facility with water pumped from the Massive Sands of the Tuscaloosa Aquifer System (TAS) at depths of about 3,000 ft.

Wastewater Handling System

The generation facility would be designed to maximize the reuse of water. Even with maximum reuse of water, a large quantity would have to be treated or discharged when the level of dissolved solids becomes unsuitably high. CGI evaluated three alternative methods for the handling of this process wastewater: (1) discharge to a surface water body, (2) discharge into a deep reinjection well, and (3) a zero-discharge evaporative system.

Discharge to a Surface Water Body – The closest existing water body capable of receiving process wastewater with high solids concentration is the Big Black River, about 35 miles southwest of the proposed generation facility site. This would require construction and operation of a 24-in. diameter pipeline. Because of the high initial construction cost and associated environmental impacts, CGI has rejected this wastewater disposal method.

Discharge into a Deep Reinjection Well – Under this disposal alternative, process wastewater would be pumped into a deep well. MDEQ regulations require that a deep reinjection well must be beneath the lowermost formation containing an underground source of drinking water within five miles of the well. The nearest suitable existing deep reinjection well is located near Baton Rouge, Louisiana. Transportation costs for use of this existing well would be prohibitively high. Additionally, a new reinjection well would only be approved by MDEQ if CGI showed that no other disposal methods were feasible. Because other methods are feasible, CGI has rejected use of a deep reinjection well.

Zero-Discharge System – This method would use a system such as a water softener, reverse osmosis, or evaporator to remove silica and dissolved salts from cooling tower blowdown water. The treated water would be returned to the cooling water system and the remaining salts and other solids would be disposed of in a landfill. Although this system has higher operating costs than the other wastewater disposal alternatives, it would result in fewer environmental impacts. CGI proposes to use this system at the generation facility.

2.2.1.3 Description of the Proposed Generation Facility Alternatives

The proposed facility would use two CFB boilers to generate steam to drive one extraction turbine, producing a net output of 440 MW (500 MW gross output) of electricity. The boilers would simultaneously generate 200,000 lbs/hr of process steam at 150 psig to supply the nearby EcoPlex industrial park. During typical operations, the facility would dispatch between 380 and 440 MW of net electrical generation. Major components of the generation facility and associated facilities are shown on Figure 2.2.1.3-1. A simplified facility process diagram is shown on Figure 2.2.1.3-2.

Construction activities of the generation facility would begin in the fall of 1998 and continue into the summer of 2000. Oversize and overweight facility components would be shipped by rail to Ackerman. They would then be transferred to truck, trailer, or special over-the-road vehicle for transport to the facility site on Highway 9 and Pensacola Road.

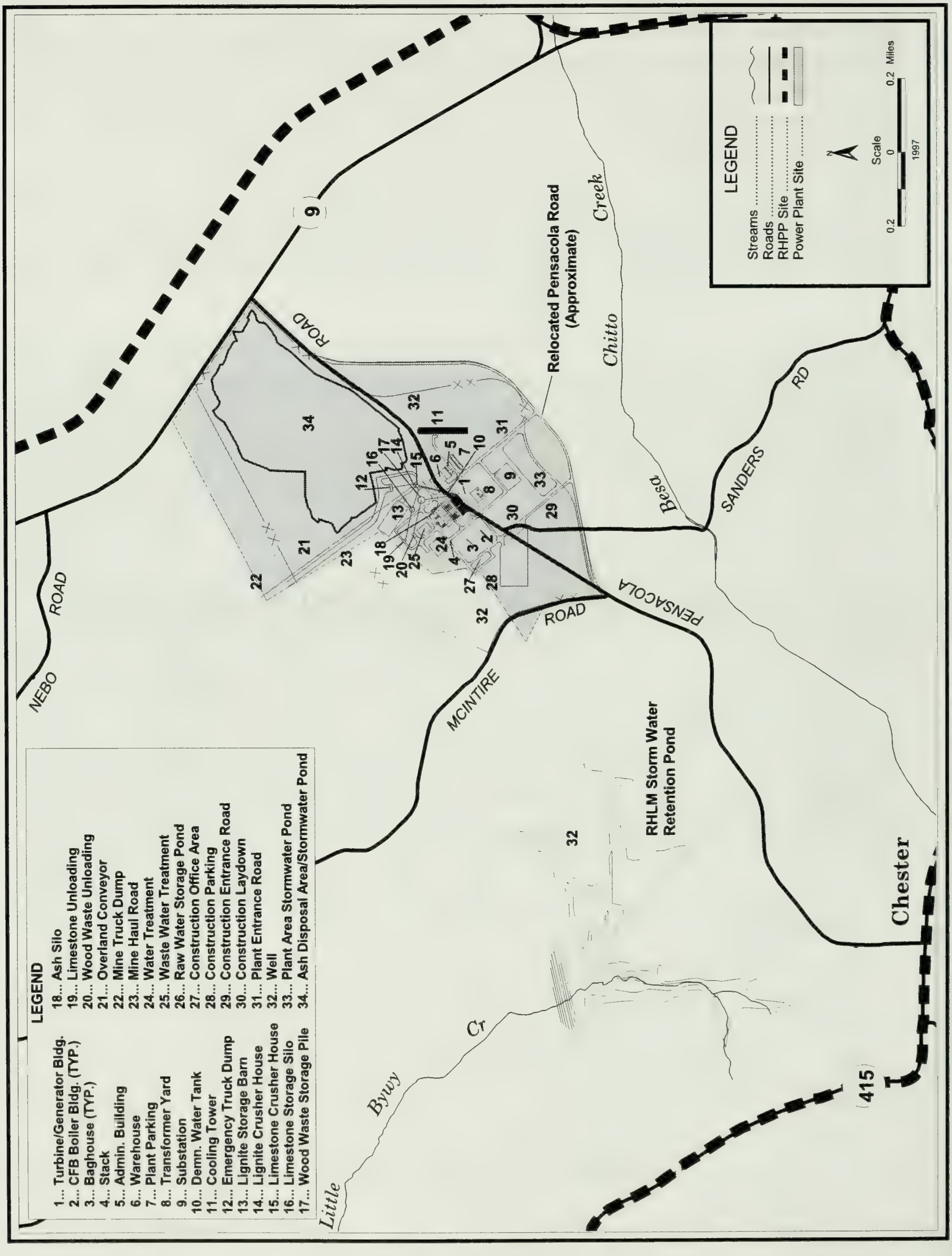
Fuels and Sorbents – Table 2.2.1.3-1 presents anticipated fuel and limestone sorbent consumption rates, as well as estimated ash and flue gas production rates, based upon the projected design net heat rate of 11,100 Btu per kilowatt-hour, the current design heat input to the boiler of 4.95 billion Btu/hour, and the expected average lignite quality. These estimates are annual averages, and would vary depending on TVA's electrical demand as well as the quality of the fuels and sorbent. The primary fuel would be lignite from the adjacent mine, consumed at the rate of about three million tpy. The limestone used as a sorbent (injected into the combustion chambers to react with sulfur in the lignite) would be acquired from existing quarries described in Section 2.2.5.

Table 2.2.1.3-1 Anticipated Material Balance for Red Hills Generation Facility

Material	**TPH**	**TPY**
Lignite Consumption	423.6	2,970,000
Wood Waste Consumption	34.9	245,000
Limestone Consumption*	33.5	235,000
Ash Production	96.5	677,000
Flue Gas Production, at rate of 6.777 tons/ton of fuel	3,100	21,700,000

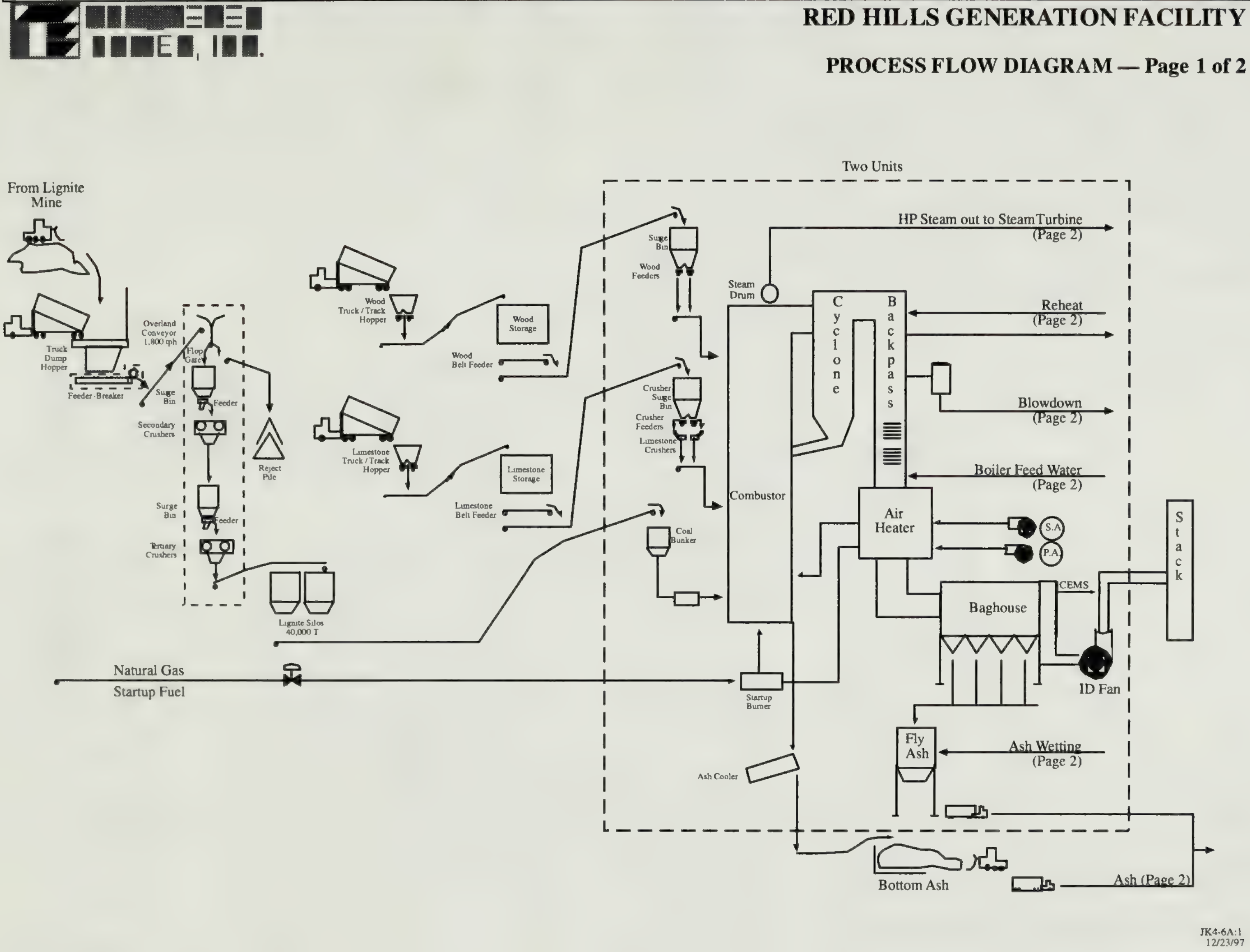
*Based on average composition of 80% calcium carbonate

Figure 2.2.1.3-1 Proposed generation facility components.



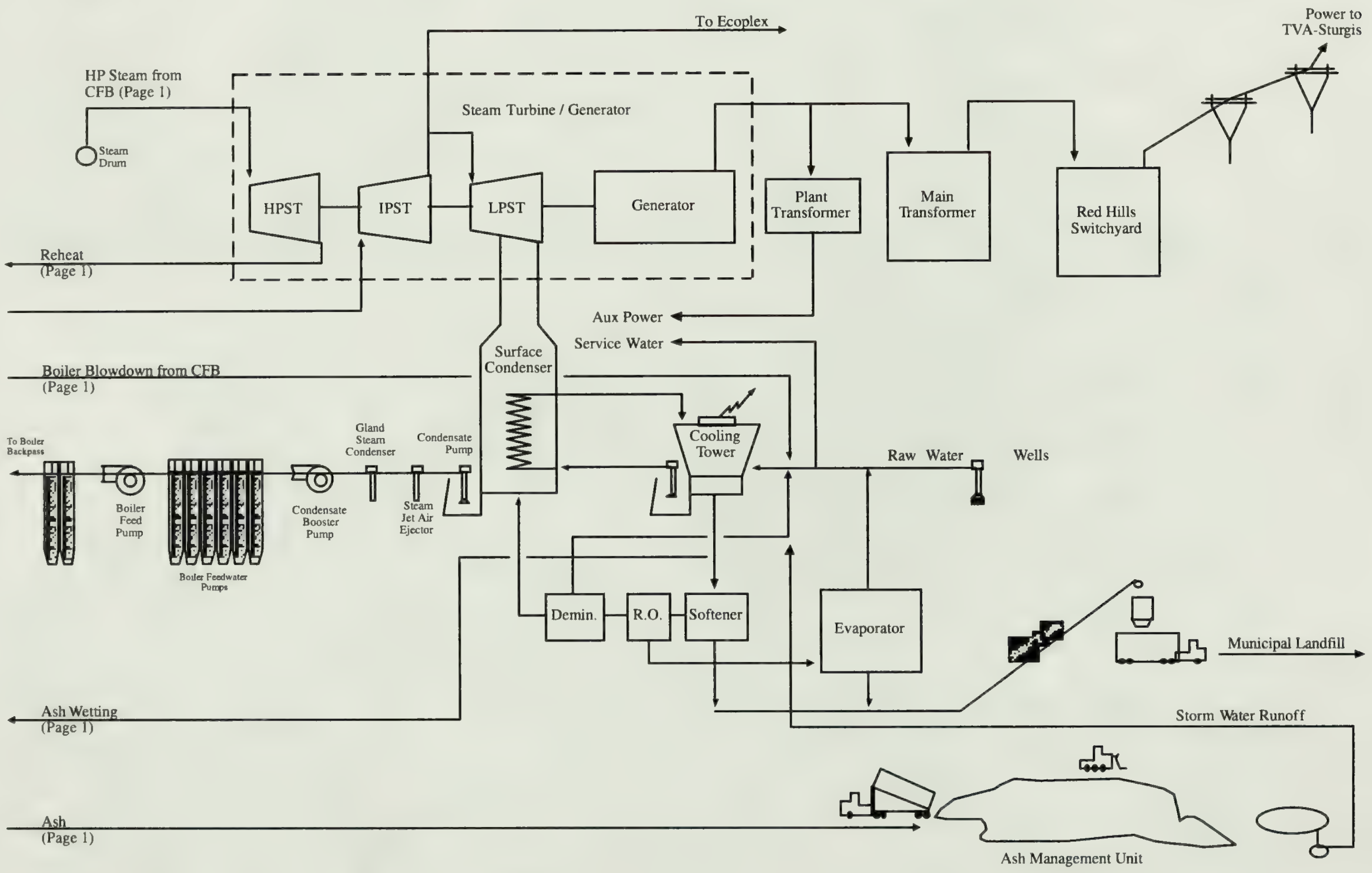
MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

Figure 2.2.1.3-2 Process flow diagram. (Tractebel)



RED HILLS GENERATION FACILITY

PROCESS FLOW DIAGRAM — Page 2 of 2



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The generation facility would also be capable of co-firing wood waste to provide up to five percent of the maximum boiler heat input. Wood waste would consist of bark and other wood wastes generated by wood product industries in the local area.

Natural gas would be burned for building heat and during startup, shutdown, and low-load operations. The natural gas would be supplied from a pipeline constructed to serve both the EcoPlex industrial park and the generation facility, as described in Section 2.2.4. The generation facility would use 100,000 million Btu (100 million scf) of natural gas annually.

Lignite Handling System – The generation facility would receive lignite from the mine at the truck dump hopper system shown in Figure 2.2.1.3-1. The lignite would immediately enter the primary crusher, where it would be reduced to 8 in. x 0 screen size. After the primary crusher, the lignite would be transported to the generation facility by a single overland conveyor. A magnetic separator at the end of the conveyor would remove ferrous metals. The lignite would then discharge through a flop gate into either a surge bin, feeding the secondary lignite crushers, or onto the emergency stockout chute. The secondary crushers would reduce the lignite to less than 1 in. x 0 screen size. Depending upon the ultimate requirements of the boiler manufacturer, a third stage of crushing could also be required. An emergency truck delivery system would be available for use when the overland conveyor from the truck dump to the secondary crusher is unavailable.

The lignite would be sampled to optimize boiler fuel usage. As currently envisioned, a conveyor would transfer the lignite to temporary storage for up to about 40,000 tons of lignite, a four-day supply. The temporary storage may consist of either two 20,000-ton silos or an enclosed storage barn. The lignite would then be conveyed from the storage facility to the boiler feed bins for eventual injection into the boilers.

Wood Waste Handling System – Wood waste would be delivered to the facility by trucks, unloaded onto a conveyor, and transported to a stockpile (Figure 2.2.1.3-1). The stockpile would store up to a five-day supply (4,190 tons). Conveyors would move wood from the stockpile to bins feeding each boiler.

Limestone Handling System – About 175 trucks, with a 23-ton capacity would deliver limestone to the generation facility each week. Potential limestone sources are described in Section 2.2.5. The limestone would be dumped into a hopper and conveyed to a limestone storage shed (Figure 2.2.1.3-1). The shed would store up to a seven-day supply (5,635 tons). Conveyors would transport limestone from the storage shed to a limestone crusher building; following crushing, limestone would be transported by conveyors to the boiler feed bunkers. Each bunker would hold enough limestone for at least 12 hours of facility operation.

Steam Generators – The proposed generation facility would use two CFB boilers as the primary steam generating units. A CFB unit operates by burning lignite in a suspended "bed" of limestone sorbent that is fluidized by upward jets of hot air. The limestone acts as a reagent to capture most of the SO_2 gases emitted by the burning lignite. Each CFB unit would be rated at about 250-MW capacity, and designed

for a maximum continuous generation of 1,750,000 lbs/hr of steam at 2,400 psig and 1000°F when burning the design lignite.

Two natural gas-fired auxiliary boilers would provide alternate sources of steam during startup, shutdown, and low load operations for generation facility uses and for the proposed EcoPlex industrial park. At their maximum combustion rate, each auxiliary boiler would consume about 335 million Btu/hr (5,500-scfm) of gas.

<u>Steam Turbine Generator</u> – Steam from the boilers would be piped to a single main steam turbine generator. The turbine converts the heat energy of the steam to mechanical energy by spinning the turbine blades. The steam turbine, in turn, drives a generator shaft which converts the mechanical energy into electricity. Electrical energy produced by the generator would pass through a generator step up transformer to increase the voltage from 24 kV to 161 kV before being transmitted to the electrical transmission system. The turbine generator would be a tandem, compound four, flow reheat unit designed for gross generation of about 500 MW when operated at maximum capacity. Auxiliary cogeneration electrical loads would be about 60 MW for a net output of 440 MW. Process steam for the EcoPlex would be extracted from the steam turbine generator. After passing through the steam turbine generator, the remaining steam would pass through a condenser and then be piped back to the boiler feedwater system.

<u>Emissions Control Systems</u> – The generation facility would use Best Available Control Technology (BACT) to control air emissions. The BACT analysis conducted for the facility is described in detail in the PSD permit application (Choctaw Generation, Inc. 1997).

Flue gas from the boiler combustion chambers would pass through a fabric filter baghouse, where fly ash would be removed and then transferred to a fly ash silo. After passing through the baghouse filters, flue gas would be released to the atmosphere through a single reinforced concrete stack 350 ft tall. Emissions of NOx, SO_2, particulate matter less than or equal to 10 micrometers in diameter (PM_{10}), particulate matter less than or equal to 2.5 micrometers in diameter ($PM_{2.5}$), total suspended particulates (TSP), carbon monoxide (CO), volatile organic compounds (VOCs), sulfuric acid (H_2SO_4) mist, and fluorides (F^-) generated by the lignite combustion process would be controlled by the use of CFB boilers with limestone injection, the fabric filter baghouse, and combustion controls.

TSP, PM_{10}, and $PM_{2.5}$ emissions from the lignite, limestone, wood waste, and ash handling and storage facilities would be controlled by the use of fabric filters, covered conveyors, and water spray dust suppression systems. Emissions from the gas-fired emergency boilers would be controlled through the use of low-sulfur natural gas, boiler design, and combustion practices. Emissions from the diesel-fueled emergency generator and fire pump would be controlled through the use of low sulfur fuel and the engine design. Drift eliminators would control TSP and particulate matter emissions from the cooling towers.

<u>Cooling System</u> – The proposed generation facility would use a closed loop cooling water system incorporating a wet mechanical draft cooling tower, a condenser, and circulating water pumps. The design of the cooling tower has not yet been finalized. However, it would likely consist of about

18 separate cells enclosed in a single rectangular structure with a maximum height of about 60 ft, as shown on Figure 2.2.1.3-1. Hot water from the condenser is pumped into the top of each cooling tower, where a continuous upward draft is maintained by large fans. As the hot water falls through the upward draft and into the tower basin, it is cooled by evaporation. Cool water collected in the tower basin is then pumped back to the condenser.

The cooling water system would circulate about 288,000 gpm. Cooling water would be recirculated, in order to reduce the quantity of makeup water needed. Water evaporation in the cooling tower would cause a concentration of chemicals, which, if not controlled, would cause scale to form on the condenser tubes and decrease efficiency. To prevent this, a portion of the cooling water would be continuously replaced or "blown down" to maintain low levels of dissolved solids. Because of the replacement of blowdown water and evaporative losses, a continuous source of about 4,600 gpm (6.33 million gpd) of blowdown makeup water would be required from the facility raw water system for cooling needs.

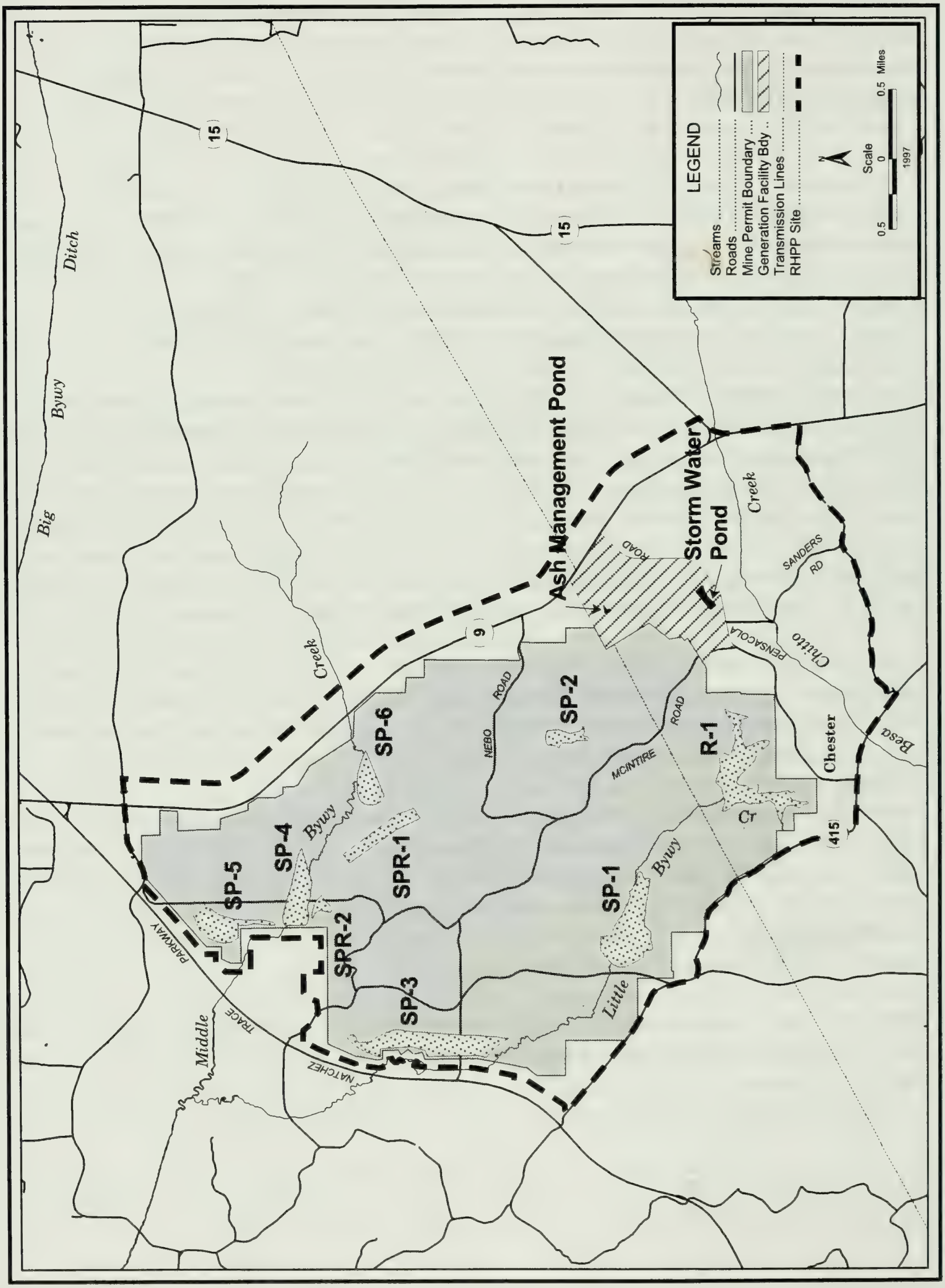
<u>Water Supply Systems</u> – With the use of the wet mechanical draft cooling tower system and maximum water reuse, a continuous source of about 4,600 gpm (6.33 million gpd) of raw process water would be required by the generation facility. This water would likely be supplied by three wells located within half a mile of the facility, as shown on Figure 2.2.1.3-1. The wells would pump water from the Massive Sands of the Tuscaloosa Aquifer System at depths of about 3,000 ft. Each well would be capable of supplying half the water needs so that full water demands could be met with one well not in operation. In the unlikely event that future pump tests indicate that more than two wells are required to provide the needed flow, one or more additional wells would be installed to maintain a spare well.

In the event of an electrical failure or pipeline rupture, the lignite mine stormwater runoff pond R-1 would be used as an emergency source of makeup water. Depending on the water level in pond R-1, at least a two-day water supply should be available. Pond R-1 would be located about a mile southwest of the generation facility (Figure 2.2.1.3-3).

Most of the water from the raw water supply system would be pumped directly into the cooling tower basin, where it would be treated with a biocide such as chlorine to control bacterial growth. Blowdown from the cooling tower would be processed for removal of silica and other dissolved solids. Part of the effluent from the silica removal process would be sent back to the cooling tower basin and the balance would be further processed to produce boiler makeup water. This condensate grade water would be stored in a tank and used, as needed, for boiler makeup.

Reject water from the silica removal process, about 100 gpm, would be used to wet the ash to control dust. Reject water from the boiler makeup water production process would be returned to the cooling tower basin for reuse.

Figure 2.2.1.3-3 Surface water control structures for generation facility and mine.



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Raw water not sent to the cooling tower basins would be processed for salt removal and used for generation facility service and wash down water.

Potable water would be provided by the Choctaw Water Association. An onsite well drawing from the Lower Wilcox Aquifer at a depth of 200 to 300 ft would be used as a backup supply. Potable water use would be about 3,000 gpd.

Wastewater Handling Systems – The generation facility would be designed for maximum reuse of process water, and there would be no wastewater discharged from facility systems. About 100 gpm of wastewater from the silica removal process would be used to wet the ash to control dust.

Several alternative methods for removing silica and dissolved salts from the makeup water are available and include magnesium oxide water softening, reverse osmosis, anion-cation mixed-bed demineralization, evaporation, and electro-deionization. If a water softening system were ultimately used, about 39 tpd of sludge, composed mostly of calcium carbonate and calcium sulfate, would be produced. An evaporator could produce about 16 tpd of salt cake consisting mainly of sodium chloride. Any such salt cake would be disposed of in an approved offsite landfill. Alternatively, the waste stream from the evaporator could be used to provide the water source for ash conditioning and, in that case, no salt cake would be produced. Reject streams from other treatment equipment would be returned to the cooling tower basin and reused.

Sanitary wastewater would be discharged to an onsite septic field. Stormwater runoff from the generation facility site would be collected by a yard drainage system and piped to a stormwater pond adjacent to the facility (Figure 2.2.1.3-1). Potential stormwater run-on to the facility site would be controlled by ditches and berms and directed to the stormwater pond. Runoff from internal facility drains and the fuel storage and handling areas would be piped to a collection basin, chemically treated as necessary, and routed to the facility cooling system. All water from areas where oil contamination is possible would be routed through an oil-water separator prior to entering the collection basin.

Ash Management – The generation facility would generate about 96.5 tph (677,000 tpy) of ash (Table 2.2.1.3-1). This would include both bed ash and fly ash, and would be made up of the ash in the lignite and the reaction products of the sulfur in the lignite and the limestone sorbent. While it is not possible to accurately forecast the amount of bed ash versus fly ash, the amount of fly ash would likely be several times the amount of bed ash. The ash would be transported from the boiler or baghouse to storage silos: the fly ash pneumatically through a pipe system, and the bottom ash by a wet drag conveyor system. Fly ash and bottom ash would be transported by truck to the ash management unit. The ash management unit, located between the facility and Highway 9 (Figure 2.2.1.3-1), would be capable of holding the ash produced by 10 years of facility operation. The ash is classified as Industrial/Special Waste in the state of Mississippi and the landfill would be subject to the permit requirements and regulations of MDEQ. To reduce long-term ash storage needs, CGI would try to market ash for beneficial use in industrial processes, in road building, as a soil amendment, or for other uses.

2.2.2 Red Hills Lignite Mine

2.2.2.1 Mine Location

The lignite mine would be located in central Choctaw County, Mississippi (Figure 2.2.2.1-1). As part of the process of choosing the mine location, PCC compared the lignite reserve at the proposed mine location with its leaseholdings elsewhere in Mississippi. Criteria used in this comparison included the following:

- size of recoverable reserve sufficient to supply a 200- to 500-MW generation facility for at least 30 years;
- economy of mining, based on the total depth of overburden (nonlignite materials above and between seams of lignite), thickness of the lignite seams, quality of the lignite, competing surface land uses, and initial mine development costs;
- location of the reserve in relation to connecting the proposed generation facility to the electrical distribution system;
- environmental factors; and
- a strong current lease-hold position.

In each of these categories, the site of the proposed reserve ranked equal to or higher than other potential reserve sites.

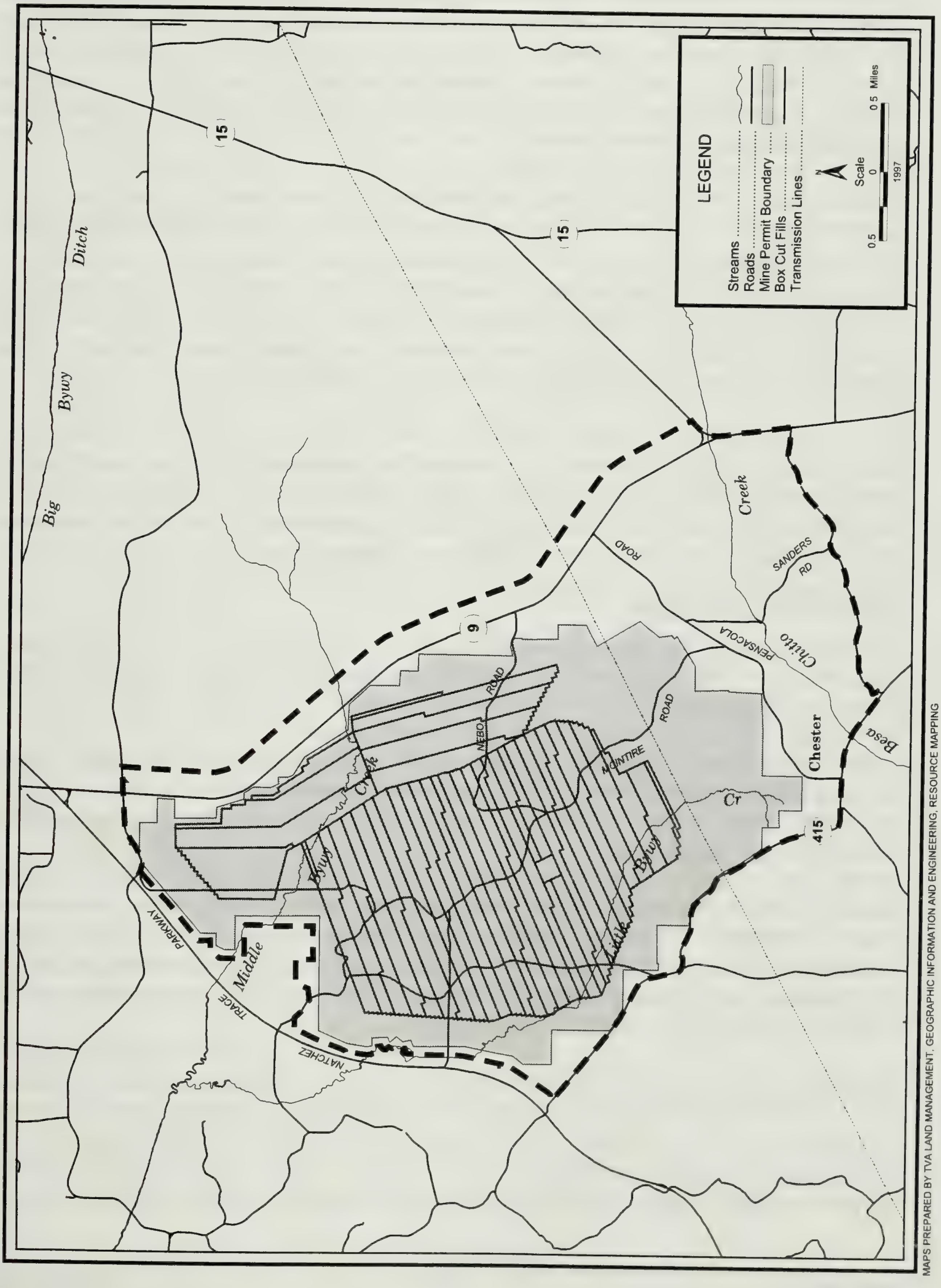
2.2.2.2 Mine Operations Alternatives

<u>Mining Methods</u>

Alternative mining methods available for lignite extraction are: (1) underground mining, (2) auger mining, and (3) surface mining.

<u>Underground Mining</u> – The reserve consists of several lignite seams separated and overlain by largely unconsolidated overburden, the material covering the lignite. The lignite seams and the layers of overburden vary in slope and thickness. Safely supporting the mine roof while leaving room for mining equipment to operate would be very difficult and expensive, and require numerous large lignite support pillars, resulting in a low lignite recovery rate. Over time, the ground surface would also likely subside, resulting in shallow depressions. For reasons of safety, cost, and lignite recovery efficiency, underground mining was therefore dismissed as impractical.

Figure 2.2.2.1-1 Lignite mine.



Auger Mining – Auger mining is typically used to recover coal remaining beyond the final cut of a surface mine where the overburden has become too thick for economical removal. This situation is most prevalent in contour mines on steep slopes, and is most efficient where seams are thicker than those in the Chester Reserve. Use of auger mining is impractical for this reserve and would not increase the efficiency of lignite recovery. For these reasons, auger mining was dismissed by MLMC as an impractical mining method.

Surface Mining – Based on the thickness and layering of the lignite seams, the composition of the overburden, and the energy content of the lignite, surface mining was determined by MLMC to be the only practical mining method. Surface mining would also maximize the resource recovery and, consequently, the royalties to landowners. Mining would consist of removing the overburden and then the exposed lignite seam with excavating equipment. This sequence would be repeated for each of the six lignite seams to be mined. After the lignite is removed from the lowest seam, the mine pit would be refilled with overburden removed from the excavation of the next mining cut.

TVA has reviewed MLMC's rationale for selecting surface mining as the proposed mining method and agrees with it. Compared to underground mining, surface mining would have greater environmental impacts, at least initially. However, surface mining reclamation requirements would substantially mitigate many adverse effects and return surface lands to at least comparable and/or more productive land uses as the performance standards required for mine reclamation are completed.

Overburden Removal Methods

Alternative methods for removing overburden include: (1) bucket wheel excavators, (2) draglines, (3) truck/shovel, (4) dozers, and (5) a combination of these methods. All of these methods have similar environmental impacts.

Bucket Wheel Excavators – A bucket wheel excavator consists of a large diameter wheel with attached excavating buckets. Overburden removed by the buckets could then be transported from the pit by trucks or a conveyor system. Because of high capital and operating costs, bucket wheel excavators were not considered an economical alternative.

Draglines – Draglines efficiently remove large quantities of overburden up to about 150 ft thick. Because the overburden proposed to be mined averages 156 ft and in places exceeds 250 ft, a dragline could not be efficiently used for all overburden removal. However, a dragline with a bucket capacity of 79 yd^3 could be used to remove overburden of the lower two lignite seams. This electric-powered dragline would operate from a bench within the mine pit.

Truck/Shovel – This method uses a diesel- or electric-powered shovel to excavate overburden and load it into large dump trucks, which then remove the overburden from the area. While this method involves more individual pieces of equipment than a dragline, it offers increased flexibility in operating in overburden of varying thickness. The equipment also is frequently suitable for other mine operations and reclamation purposes. Truck/shovel could be used to remove overburden above the upper lignite seam.

Dozers – Large dozers are an effective and economical method of removing thin layers of overburden when there is an adjacent pit into which the overburden can be pushed. Dozers could be used for this purpose at the mine.

Combination – The mine could use a combination of overburden removal techniques. A truck/shovel system would remove overburden above the uppermost lignite seam, dozers would remove overburden from the next three seams, and a dragline would remove overburden from the lowermost two seams.

Lignite Loading Methods

Alternative methods evaluated for loading lignite include: (1) surface continuous miners, (2) front-end loaders, and (3) hydraulic backhoes. Use of either front-end loaders or hydraulic backhoes would require prior ripping of the lignite seam (following overburden removal) by a dozer with a ripping blade. Prior ripping would not be necessary with a continuous miner, and use of blasting to loosen lignite would not be necessary with any of the loading methods. All of these alternative methods have similar environmental impacts.

Surface Continuous Miner – A surface continuous miner ("Easi-miner") is a large-tracked vehicle with a large bottom-mounted rotating drum. Teeth in the drum break out the lignite, which is directed onto a conveyor system and directly loaded into dump trucks. Use of a surface continuous miner was rejected because of its need for long loading areas, its low efficiency in mining relatively thin lignite seams (such as those at this mine), its poor maneuverability, and its high operating cost relative to front-end loaders and hydraulic backhoes.

Front-end Loaders – Front-end loaders with bucket capacities of 20 to 35 yd^3 were considered. Compared to hydraulic backhoes, they have the disadvantage of being limited in their ability to operate on the lignite seam, and trucks to be loaded must be on the mine pit floor where traction conditions may be poor. Conversely, front-end loaders are highly maneuverable and are efficient in loading multiple lignite seams. Therefore, a 23 yd^3 front-end loader was selected by MLMC for use as a backup loader to the hydraulic backhoe described below.

Hydraulic Backhoes – Diesel-powered hydraulic backhoes are maneuverable and efficient at removing virtually all the exposed lignite from thin seams, while minimizing loading of waste material. Hydraulic backhoes can operate and load trucks on top of the lignite seams. This feature allows a smaller overall mine pit by minimizing the need for maintaining roads on the adjacent pit floor. For these reasons, hydraulic backhoes were selected by MLMC as the primary alternative for loading lignite at RHLM.

Lignite Transportation Methods

Alternative methods for transporting lignite from the mine to the lignite handling facility include: (1) trains, (2) conveyor belts, and (3) trucks.

Trains – Transporting lignite from the mine to the generation facility by train was rejected as an impractical alternative by MLMC. Use of rail transport would require a separate system of moving

lignite from the constantly moving pit to a train-loading area, as well as train turnarounds at both the loading and unloading areas. This rail system would be impractical over the short distance (maximum of about four miles) from the mine to the generation facility. The rehandling of the lignite and large land requirements would also result in environmental impacts not associated with the other transportation methods.

Conveyor Belts – Use of a conveyor belt system to transport lignite from the mine face to the lignite-handling facility would provide a continuous hauling system and reduce the need for a haul road system. However, a conveyor system would require a large capital investment and frequent relocation as the pit moves. Use of a conveyor belt system was therefore rejected by MLMC.

Trucks – Large 150- to 170-ton capacity, rear-dumping trucks could be used to transport lignite from the mine pit to the lignite handling facility. Trucks offer high mobility and flexibility, and the same trucks could be used for truck/shovel overburden removal. This alternative was chosen by MLMC.

Reclamation Methods

As required by federal and state surface mining regulations, reclamation of mined areas would occur concurrently with other mining operations. Applicable regulations require grading to return mined areas to approximately their original contours, establishment of plant cover, and return of mined areas to equal to or greater productive land uses. The main reclamation alternative available to MLMC is the use of either (1) topsoil replacement or (2) topsoil substitution.

Topsoil Replacement – Topsoil replacement consists of removing and stockpiling the topsoil prior to mining and, following mining and regrading, spreading it over the area being reclaimed. Because of the insufficient quantity and poor quality of native topsoil over most of the proposed mine area, this technique would not be sufficient to reclaim the mined areas.

Topsoil Substitution – Topsoil substitution consists of removing selected overburden materials, and spreading them over the area being reclaimed. Based on available soils data, this reconstructed soil is anticipated to be of comparable or higher quality than existing native soils. MLMC proposes to use selected overburden materials for topsoil substitution at the mine.

2.2.2.3 Description of the Proposed Lignite Mine

The following provides a summary of the development, operation, and reclamation of the proposed mine. A more detailed description is available in the Surface Mining and Reclamation Permit Application submitted by MLMC to the Mississippi Department of Environmental Quality (MDEQ). Copies of this application are available for public review at the Choctaw County Courthouse in Ackerman, Mississippi, and at the MDEQ Office of Geology in Jackson, Mississippi.

The area proposed to be mined, in central Choctaw County, Mississippi, is divided into three mine areas (Figure 2.2.2.3-1). The boundaries of these mine areas are determined by the presence of existing roads, streams, houses, and high voltage transmission lines, as well as the ratio of overburden to lignite. Mining

operations would proceed from south to north in Mine Area 1, then west to east in Mine Area 2, and finally west to east in Mine Area 3. No mining would occur within 100 ft of the cemetery located just south of the center of Mine Area 1. The areas to be mined each year are sized to provide a relatively constant annual supply of about three million tons of lignite per year to the generation facility.

Over the life of the mine, an annual average of 127 acres would be disturbed and reclaimed. This area includes approximately 5,800 acres, of which 1,900 acres would be disturbed during the initial construction period of the mine and approximately 3,800 acres would be disturbed and/or mined during operations. Therefore, of the total 5,800-acre mine area, about 5,700 acres would be disturbed.

Mine area development activities would begin in late 1998. Overburden removal would begin in 1999 and lignite removal would begin in 2000.

Mine Development

In addition to procuring equipment, hiring the workforce, and conducting additional engineering and design studies, these mine development activities would include the following construction activities.

Access Roads – The primary access to the mine would be from McIntire Road just north of Pensacola Road. McIntire Road would be temporarily closed between Pensacola and Nebo Roads. Other roads within the mine area would be closed or rerouted as needed to accommodate mine operations. Prior approval by Choctaw County Board of Supervisors would be necessary for any road closures and relocations. Access by surface owners would be provided to lands not being mined. Surface owner access to lands actively mined would be allowed by permission of MLMC for safety reasons.

Mine Support Facilities – Mine support facilities would consist of a shop and warehouse building, an office and change house building, parking areas, a bucket shed, a fuel tank farm and fueling area, a vehicle ready line, a wash pad, and a dragline erection site. The proposed location of these facilities are shown on Figure 2.2.2.3-2. The shop and warehouse building would consist of four vehicle repair bays and storage areas. The office and change house building would contain administrative and engineering offices, showers, and locker rooms. Paved parking areas would provide parking for 130 employees and 50 visitors. The bucket shed would house at least one dragline bucket for repairs. The fuel tank farm would contain two 50,000-gallon tanks for diesel and a 1,000-gallon tank for gasoline. The fuel tanks would be surrounded by dikes to contain potential spills and would conform to all applicable federal, state, and local regulations. The vehicle ready line would provide parking for haul trucks, motor graders, pickup trucks, and other vehicles used during mining operations. A vehicle wash pad area would be equipped with a high pressure wash hose to clean heavy equipment and washwater would be routed to a sedimentation pond for reuse. The dragline erection site would consist of six acres of graded, graveled,

Figure 2.2.2.3-1 Three mine areas.

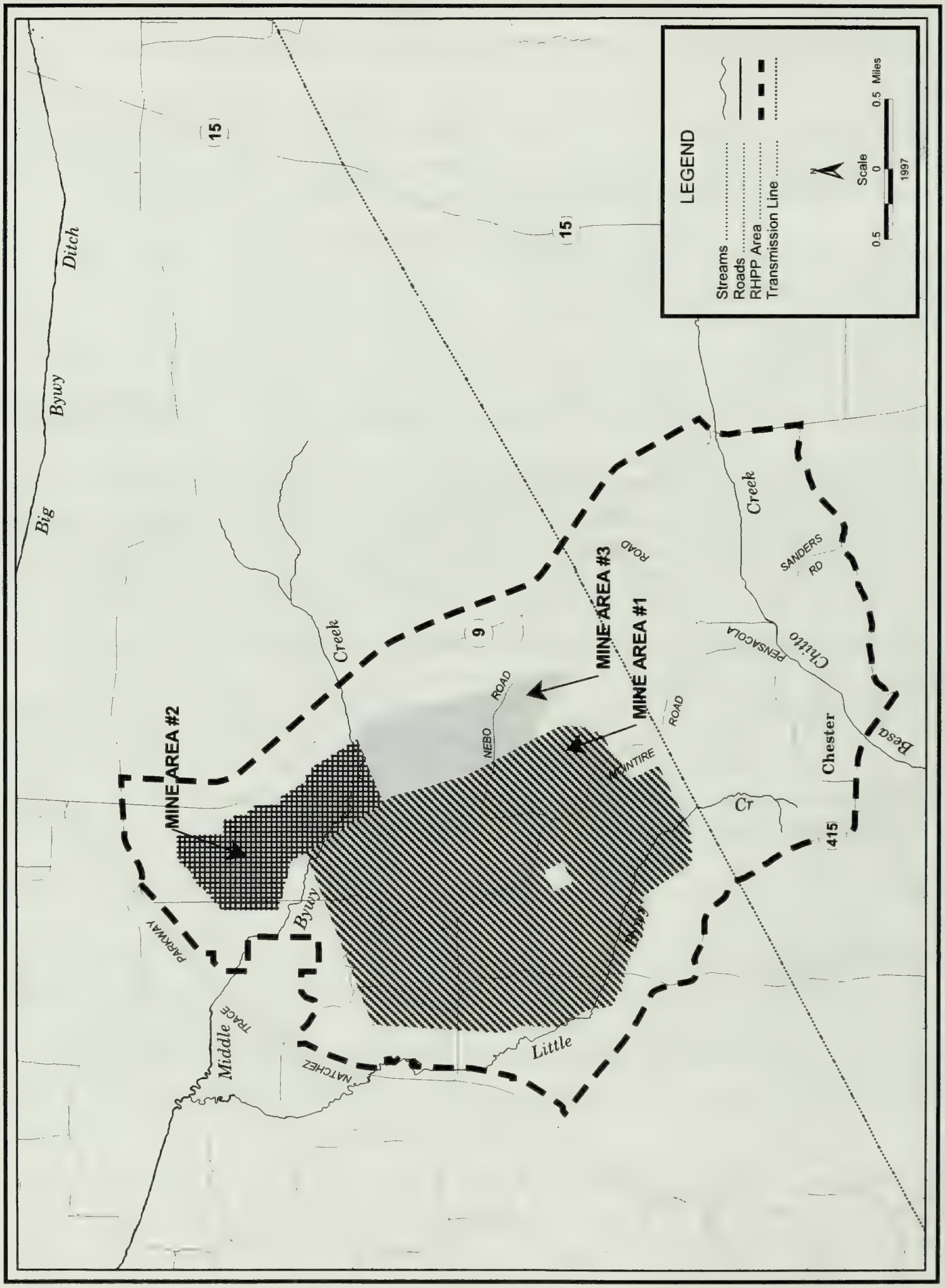


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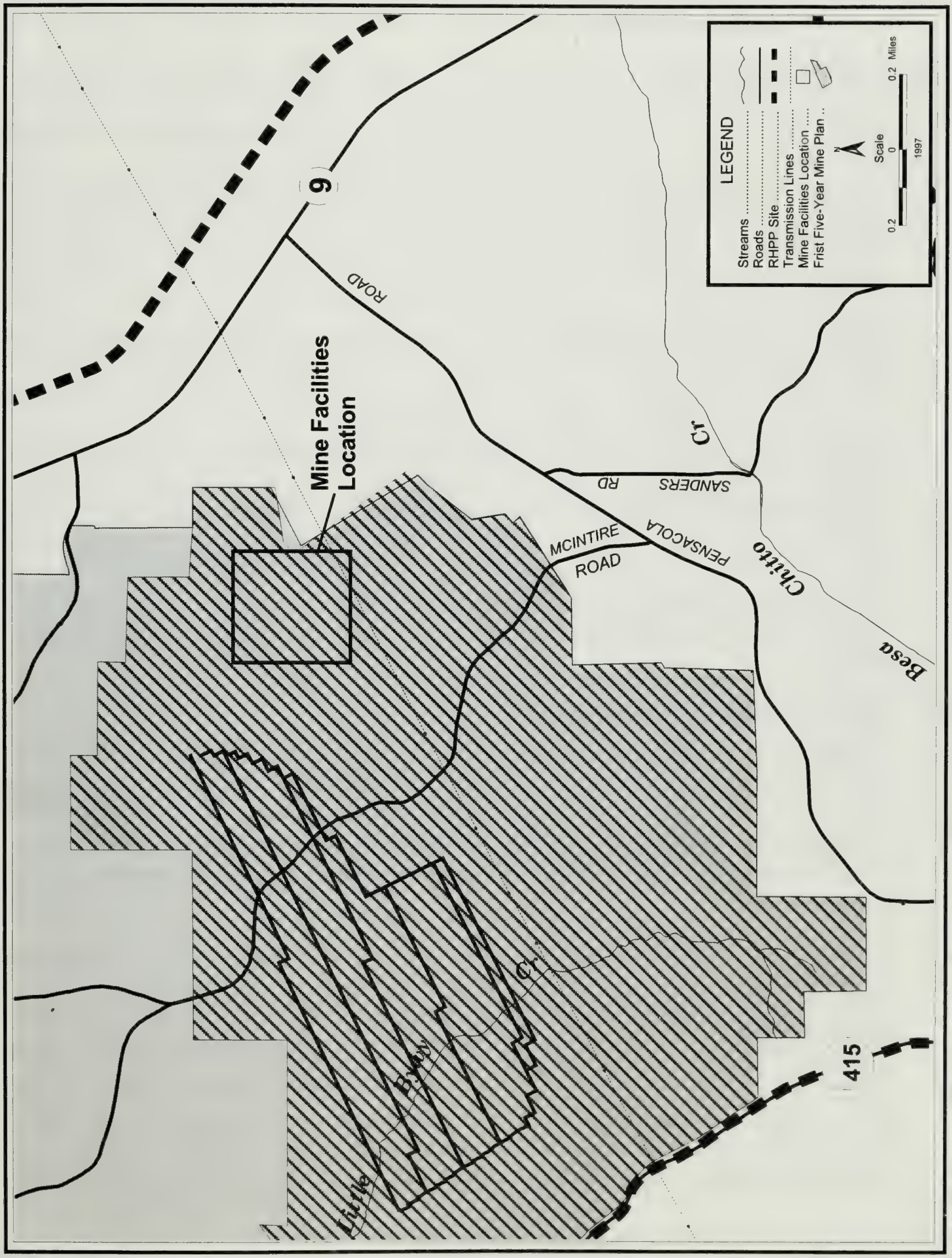
Figure 2.2.2.3-2 Mine facilities location and first 5 year mine plan.



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and concrete pad used for assembling the dragline. Following completion of the dragline, the site would be used to store parts and supplies.

Lignite Handling Facility – The mine-related lignite handling facility would consist of a truck dump hopper and a 12-acre stockpile, capable of storing enough lignite for 15 days of generation facility operation. Trucks on an elevated ramp would dump lignite straight into the 400-ton capacity hopper. The hopper would feed lignite directly to the primary lignite crusher at the generation facility. Handling of the lignite from this point on was described in Section 2.2.1.3. If the crushing and conveying system is not operating, or if lignite from different seams must be blended to maintain fuel quality standards, the lignite haul trucks would unload at the stockpile. A front-end loader would be used to move lignite from the stockpile to the hopper.

Water Control Structures – The major surface water control structures for the proposed mine are illustrated in Figure 2.2.1.3-3. These structures consist of temporary diversions of Little Bywy Creek, Middle Bywy Creek and their tributaries around the proposed mine and construction of sedimentation ponds. Stormwater runoff control pond R-1 and sedimentation control ponds SP-1 and SP-2 would be constructed during the mine development period. Sedimentation control ponds SP-3 and SP-4 would be constructed 5 or 6 years later. Ponds SPR-1 and SPR-2, required for mining after year 29, would be constructed later in the mining cycle on reclaimed mineland. All temporary impoundments would be designed for later removal and site reclamation. It is possible some ponds would be left in place as permanent features. No controls for groundwater, such as dewatering or depressurization, would be required. Portable electric and/or diesel-powered pumps would be used as necessary to remove water from the mine pit. This water would be piped to the nearest sedimentation pond for treatment, as required.

Pollution Control and Waste Management

In addition to the sedimentation ponds described above, other sediment control measures required by regulation would be used to prevent sediment runoff from leaving the active mine area. These include use of Best Management Practices (BMPs) such as sediment traps, silt fences, and grass strips to control storm water runoff from roads and other mine facilities. Water from the vehicle wash facility would be treated by a sedimentation pond. Sewage from the office facilities would be treated by a sewage treatment plant.

The primary air pollutants generated by the mine would be particulates (dust) and vehicle exhaust. Dust generated by vehicle movement would be controlled with water trucks, using water pumped from a sedimentation pond. Where necessary, binding materials such as lignum sulfonate or magnesium chloride would also be used for dust control. The mine would not have any permitted stationary sources of emissions.

All fuel and lubricant storage areas would be surrounded by containment berms and the mine would have a Spill Prevention Control and Countermeasure Plan in place. Used oil and grease would be recycled through offsite facilities. The amounts of waste generated from use of other chemicals, such as paints

and cleaners, would be very small and the mine would be a Conditionally Exempt Small Quantity Generator or a Small Quantity Generator of hazardous waste under the Resource Conservation and Recovery Act (RCRA). Other office and shop wastes would be removed by a local waste disposal company and hauled to a permitted local landfill.

Mine Operations Sequence

Overburden removal would begin in 1999 and continue to the year 2037. They would start with the removal of vegetation from the area to be mined. Marketable timber would be harvested and dozers would then remove the remaining vegetation. Remaining cleared vegetation would be piled and burned or backfilled into an open mine pit. Overburden material from the initial 3,000-ft long box cut excavation would be used as fill material for the lignite stockpile area and initial mine roads; remaining overburden material would be placed in several eroded areas near the southern end of Mine Area 1. During the second and later years of mine operation, overburden material would be used to fill previously mined areas.

Overburden above the uppermost lignite seam would be removed by an electric-powered cable shovel with a 29 yd^3 bucket and trucks. Dozers fitted with single shank ripper attachments would then rip the exposed lignite seam and hauled out of the pits with trucks. The backhoe would then load the lignite into trucks, which would transport it to the lignite handling facility. Rippers, a backhoe, and trucks would also be used for lignite removal from other seams.

Following removal of the H lignite seam, dozers would push the overburden above the G lignite seam into the adjacent empty pit (Figure 2.2.2.3-3). Lignite from the G seam would be removed as described above. The same sequence would be used to remove overburden and lignite from the F and E seams. While removing overburden from the E seam, the dozers would create a flat spoil area on the adjacent mine floor, level with the E seam. The dragline, operating on this flat spoil area, would remove overburden above the D and C seams. This overburden would be placed in the previously mined pit opposite the highwall.

Overburden from the initial box cut in Mine Area 2 would be used to fill the final pit of Mine Area 1. Similarly, overburden from the initial box cut for Mine Area 3 would be placed in the final pit of Mine Area 2.

Reclamation

Following removal of the final lignite seam from a mine pit, the pit would be filled with the remaining overburden spoil from the adjacent active mine pit. At least four feet of selected overburden material–material proven capable of supporting the proposed postmining land use–would be placed on top of the graded mine spoil. Where necessary to enhance its productivity, soil amendments would be added to the reconstructed soil.

Figure 2.2.2.3-3 Typical mining operations. (MLMC 1997)

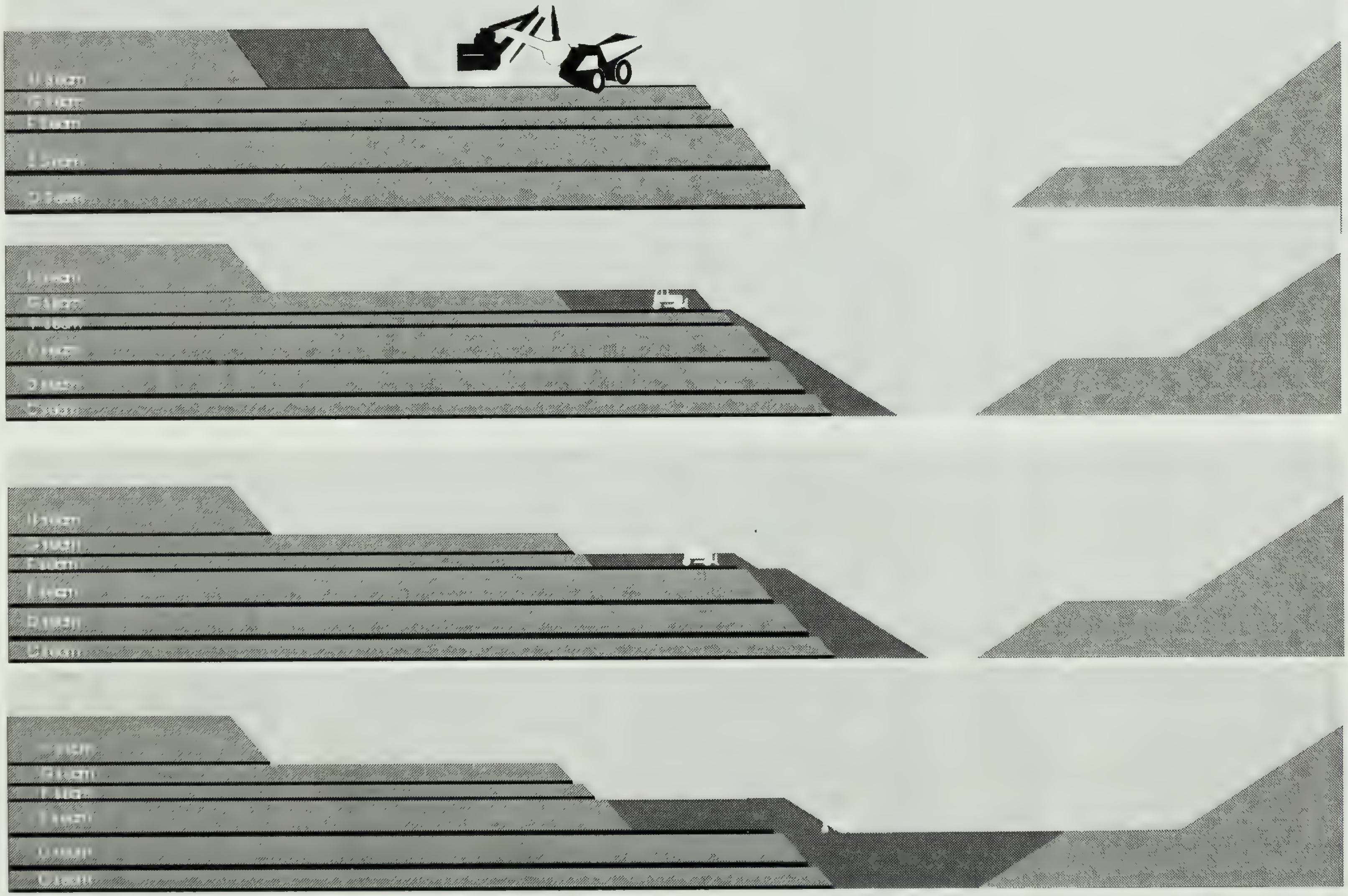
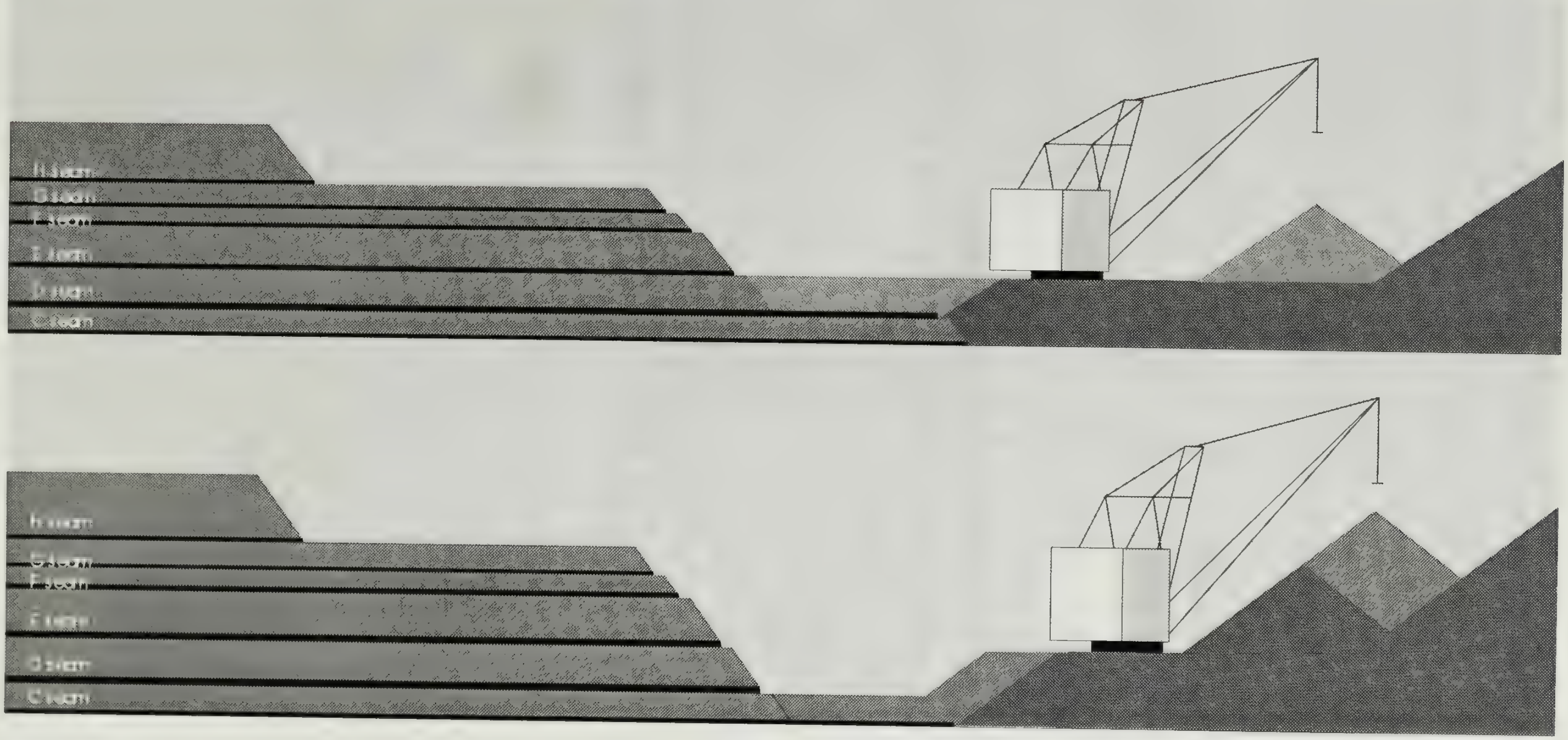


Figure 2.2.2.3-3 Typical mining operations (cont.). (MLMC 1997)



Immediately following replacement of selected overburden, a temporary cover crop would be planted or mulch would be spread over the area being reclaimed. The temporary cover crop would consist of grasses and/or legumes (Appendix B-1). Following establishment of this temporary cover, permanent vegetative cover would be established (potential species also are listed in Appendix B-1). When weather and soil conditions allow, establishment of temporary cover would be skipped and permanent vegetative cover would be planted immediately after final regrading. The plant species used in the permanent vegetative cover would vary with the postmining land use, which would be dependent on premining land use and surface landowner preferences. Potential postmining land uses include commercial forest, pasture, cropland, recreation, industrial, and wildlife and fish habitat. Based on premining land uses and soil conditions, it is anticipated that most of the mined areas would be reclaimed as commercial forest, interspersed with fish and wildlife features.

Revegetation would be carried out by local contractors or mine employees. As required by regulation, the survival of the permanent vegetative cover would be monitored for at least five years and additional plantings would not be made during this period in order to meet reclamation and bond release requirements. If additional plantings are made beyond normal husbandry practices, the five-year monitoring would begin again.

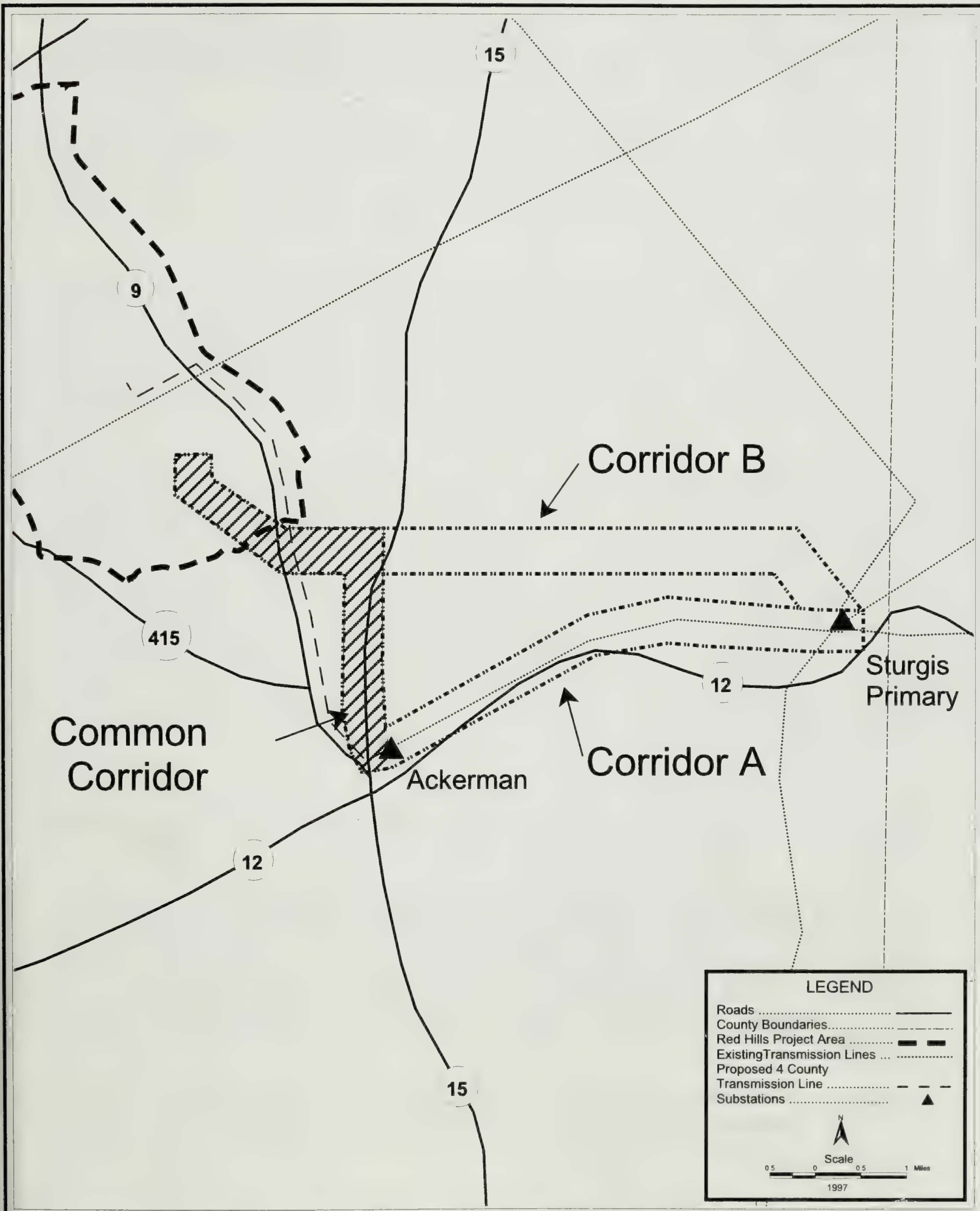
Detailed reclamation plans would be included in each five-year mine permit application renewal. These plans would describe postmining land uses, species mixtures and planting rates, as well as other features such as the disposition of sedimentation ponds and haul roads.

2.2.3 Transmission Lines

In order to connect the proposed generation facility to TVA's existing electrical transmission system, TVA would build a double-circuit, 161-kV transmission line from the facility to their existing Sturgis, Mississippi 161-kV substation. TVA would also expand the switchyard facilities in the existing Sturgis substation to accommodate the new 161-kV transmission line.

TVA uses several criteria in selecting potential transmission line corridors. Efforts are made to follow existing linear features such as railroads, pipelines, and other transmission lines, and to avoid or minimize crossing streams, wetlands, and large forested tracts. To the extent practicable, routes are also selected to avoid areas of incompatible land uses, and to maintain minimum distances of 300 ft from homes and 1,000 ft from schools. Using these siting criteria, TVA identified two alternative corridors for the transmission line; these are shown on Figure 2.2.3-1 and described in more detail in the following discussions. For study purposes, each of these corridors is 2,000 ft wide; the final right-of-way (ROW) within the corridors would vary between 100 and 175 ft in width.

Figure 2.2.3-1 Proposed transmission line corridors.



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Corridor A – Corridor A extends 2.4 miles south and east from the generation facility to the junction of the abandoned ICG Railroad and Mabus Road. At this point it turns south and parallels the railroad for about 2.5 miles before turning east, crossing Highway 15, and passing adjacent to the existing 69-kV Ackerman substation owned by 4-County Electric Power Association (4-County). The ROW width for this section would be 175 ft. From the substation it parallels an existing TVA 69-kV transmission line for 5.4 miles to the northeast and east before terminating at the Sturgis substation. The new ROW width in this section would be 112.5 ft. Total length of this line would be 10.3 miles, with 5.4 miles paralleling an existing transmission line.

Corridor B – This corridor is the same as Corridor A from the generation facility to the Ackerman substation. The ROW in this section would be 175 ft wide. Instead of the 5.4-mile segment from the Ackerman substation to the Sturgis substation, however, it would connect to the Sturgis substation by a six-mile line segment on a new ROW extending east from the junction of the abandoned ICG railroad and Mabus Road. The ROW width in this section would be 100 ft. Total length of this line would be 10.9 miles, all on new ROW.

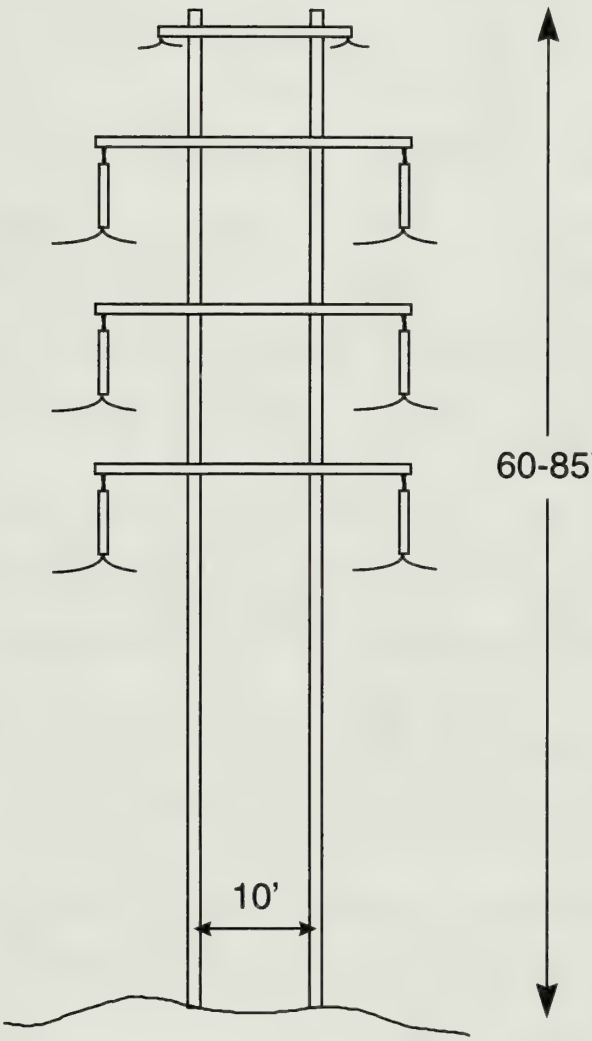
The 4-County association proposes to build a new 161/69-kV Ackerman substation near their existing 69-kV substation and a 69-kV transmission line from their new substation to the mine office area to serve the mining operations. The new substation would occupy no more than five acres. The new 4-County line would be built within the ROW of an existing 4-County low voltage distribution line parallel to Highway 9 for about five miles from the Ackerman substation north to the existing TVA 500-kV transmission line. The existing structures within this ROW would likely be replaced with new steel or wood pole structures supporting both the existing distribution line and the new 69-kV line. At the intersection of Highway 9 and the TVA 500-kV transmission line, the proposed 4-County line would turn southwest and parallel the existing 500-kV line ROW for about 3/4 mile to the mine office area. The 500-kV line ROW would be widened about 75 ft to accommodate the 4-County line.

The 4-County line would connect to a new substation adjacent to the mine office and from there extend northward into the mine area to feed the dragline and other electrical equipment. The proposed route of the 4-County transmission line is shown on Figure 2.2.3-1.

In the NOI to prepare this EIS, TVA proposed building two separate transmission lines, a 5-mile line towards the northeast and a 25-mile line connecting to the TVA Louisville substation southeast of the generation facility site. Further studies carried out since have shown that a single line along either Corridor A or Corridor B, as described above, can provide the same level of service and reliability as the two previously proposed lines. TVA has therefore eliminated the 5-mile and 25-mile lines from further consideration.

The proposed TVA transmission line would use vertical double steel pole structures with horizontal cross arms (Figure 2.2.3-2). The 4-County line would likely use single steel or wood pole structures.

Figure 2.2.3-2 Typical pole structures used for proposed TVA transmission line.



Transmission line construction activities would begin with clearing the ROW. All woody vegetation would be cleared by cutting at ground level. Stumps would be treated with EPA-approved herbicides to prevent resprouting. Heavy equipment would be used to remove stumps from pole locations and access roads. Cleared areas would be seeded with grass to encourage revegetation. In the vicinity of streams and wetlands, low-growing woody vegetation would remain undisturbed and taller trees would be cut three to four feet above the ground and their stumps left in place. Danger trees—trees outside the cleared ROW capable of falling within five feet of the conductor cables—would also be cut. Truck-mounted augers would drill holes for the placement of poles, foundations, and support cable anchors. After the poles are erected, conductor cables would be pulled into place and sagged to proper heights and tensions using tension-stringing equipment. Clearing and construction techniques are described in more detail in Appendix B-2.

After the transmission line is constructed and energized, the height of woody vegetation within the ROW would be controlled to ensure safe operation of the line. This would be done by mowing periodically, cutting with chain saws, and/or applying EPA-approved herbicides, typically on a three- to four-year cycle. The choice of vegetation management technique would be determined on a case-by-case basis depending on terrain, ROW accessibility, vegetation type, land use, presence of streams and wetlands, and economics. Danger trees would also be periodically cut.

2.2.4 Natural Gas Pipeline

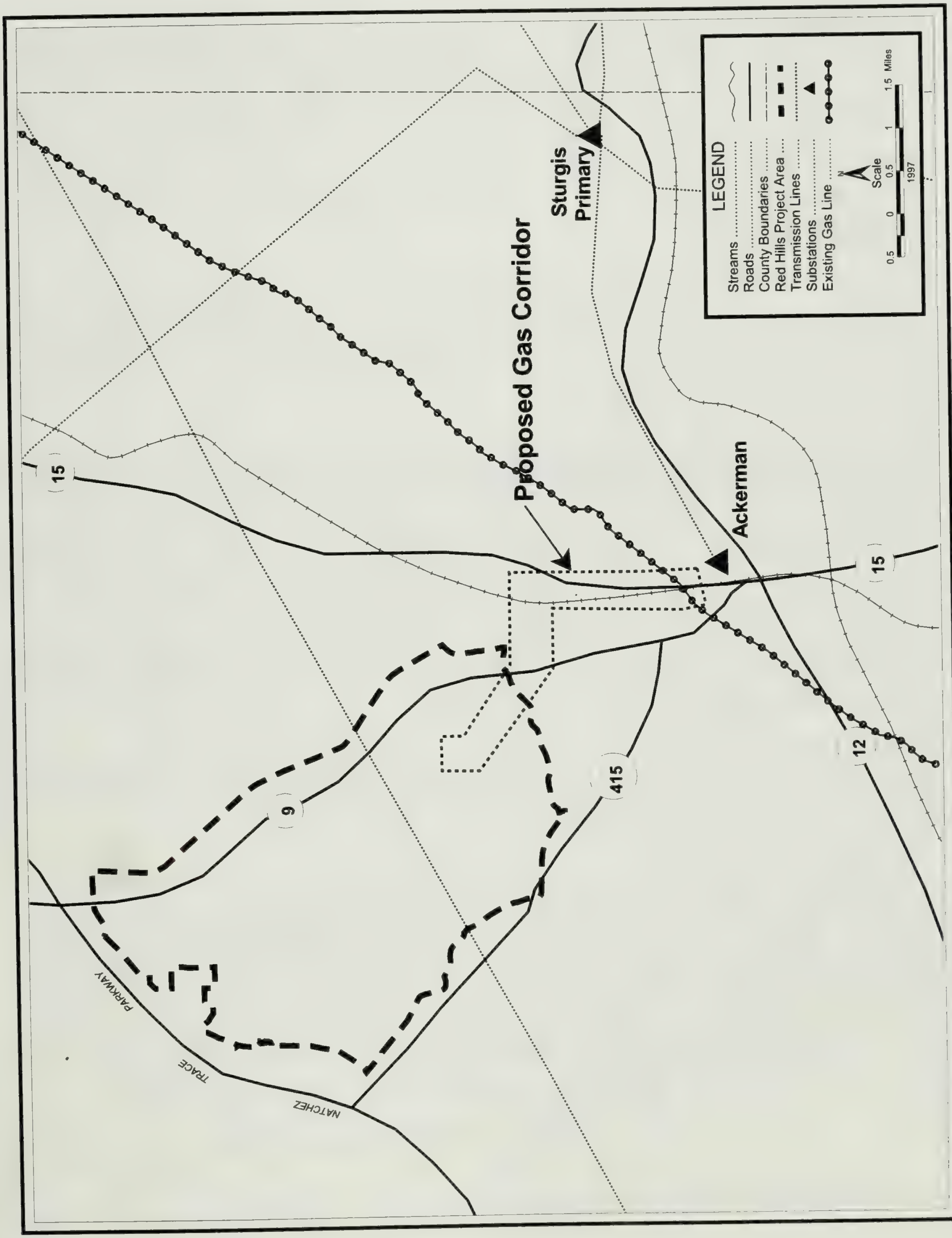
The proposed generation facility would require up to 19,000 scfm (1,150 million Btu/hr) of natural gas during startup of the main lignite-fueled boiler units and to heat the auxiliary boilers when the main units are shut down or operating at low loads. An additional amount of natural gas would also be required by EcoPlex tenants. These natural gas needs would be supplied by a single 8-in. pipeline built and operated by the Town of Weir. The Town has informed TVA that it would require its contractor to use BMPs and other standard construction practices that lessen potential impacts.

Figure 2.2.4-1 depicts the proposed location of the natural gas pipeline. The line would connect to the existing Texas Eastern pipeline north of Ackerman, and extend north and west to the proposed generation facility site, paralleling the proposed electrical transmission line Corridor A shown on Figure 2.2.3-1. The pipeline would be built within the same cleared ROW as the transmission line.

The pipeline would be buried in a trench. Topsoil would be backfilled into the trench, and disturbed areas would then be seeded with native grasses. The pipeline would be drilled under Highway 9 and Barrow Road, therefore minimizing disturbance to these roadways. It is unknown at this time whether ditching or drilling would be used to cross Besa Chitto Creek. BMPs would be used to control erosion.

Vegetation on the pipeline ROW would be maintained at a height of less than three feet, primarily by mowing semi-annually or more often if needed. EPA-approved herbicides may also be selectively applied by hand and in conformance with label specifications.

Figure 2.2.4-1 Proposed natural gas pipeline corridor.



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2.2.5 Limestone Sources

Under normal operating conditions, the proposed generation facility would require about 33.5 tph (235,000 tpy) of limestone. These quantities are based on a calcium carbonate content of 80%. At least four currently operating quarries in Mississippi (Figure 2.2.5-1) are capable of economically supplying this quantity of limestone. These are the Vulcan Materials quarry in Tishomingo County; the Limeco, Inc., quarry in Clay County; the Holnam, Inc., quarry in Lowndes County; and the Harold Lee & Sons quarry in Noxubee County.

All of these quarries deliver limestone by truck and, at the normal truck capacity of 23 tons, the generation facility would require approximately 175 truck deliveries per week. Likely truck routes are shown on Figure 2.2.5-1. The Vulcan Materials quarry in Tishomingo County is also capable of delivering limestone by rail. However, delivery by rail is unlikely in the immediate future because of the present lack of rail access to the site.

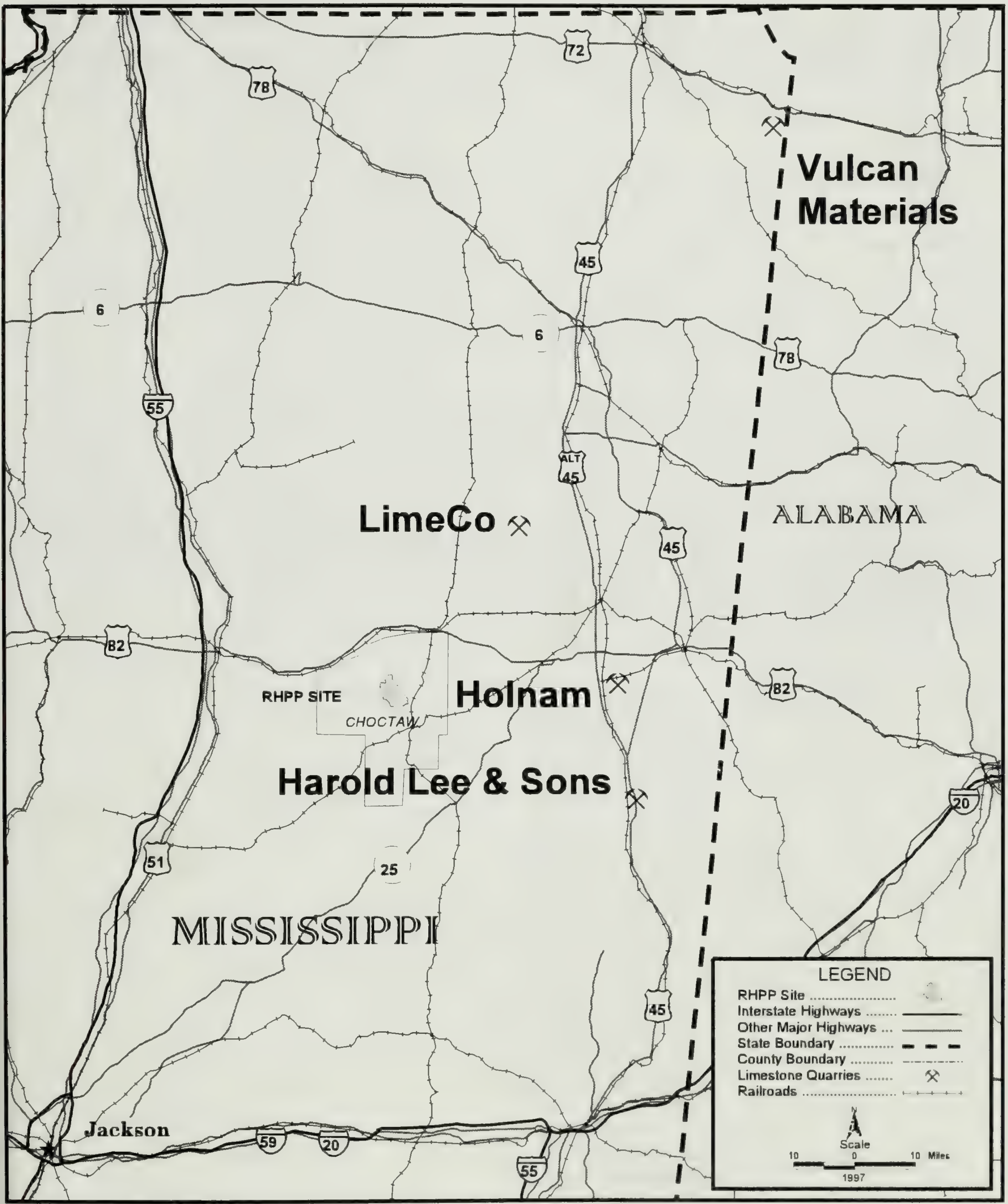
2.3 Comparison of Alternatives

Anticipated impacts of the agencies' proposed action, which would result in the construction and operation of the Red Hills Power Project and its associated facilities, are not expected to be significant. A few of the impacts, notably many of the socioeconomic impacts, would be positive. As part of the proposed action, TVA would build a new electrical transmission line in one of two alternative corridors. The environmental impacts of building this line in Corridor A (the southern route) would be less than those resulting from construction of the line in Corridor B, because Corridor A would make greater use of the existing transmission line ROW.

Measures to reduce potential environmental impacts that would be incorporated into the project design, construction, and operation are also summarized in Table 2.3-1. They are described in more detail in the discussion of potential impacts in Chapter 4.

The state of Mississippi and Choctaw County have indicated that they intend to cooperate on the development of an EcoPlex industrial park that would be located adjacent to the proposed generation facility. It is contemplated that occupants of the EcoPlex would be designed to share resources with and use wastes from the RHPP in the course of their activities. The proximity of the EcoPlex to the generation facility and its industrial nature means that it is likely that its development and operation would impact environmental resources that are common to resources potentially impacted by the RHPP. These "cumulative" impacts have been assessed in this EIS. There are no other major activities that have been proposed in the area that are likely to have material cumulative impacts with the RHPP.

Figure 2.2.5-1 Potential limestone sources.



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There would likely be cumulative impacts to air quality in the area. However, applicable federal and state air pollution control requirements would ensure that any such cumulative impacts are kept within acceptable levels. Any major source of air pollution locating in the EcoPlex would have to limit its emissions in a manner to maintain compliance with EPA's ambient air quality standards and prevention of significant deterioration requirements. The estimated cumulative loss of prime farmland soils would be acceptable, based on National Resource Conservation Service guidelines. Cumulative impacts to groundwater, surface water, aquatic ecology, wetlands, floodplains, and rare plants and animals would be negligible. Cumulatively, over 2,000 acres would eventually be converted from forest and agricultural uses to long-term industrial uses. This would constitute an important local impact on plant and animal populations as well as local land use, but would not be important from a state or regional perspective. Area noise levels, highway traffic, and demand for recreational facilities would increase while visibility of the night sky would decrease. The cumulative socioeconomic impacts would be positive through job creation, increased tax collections, and increased property values.

Under the No Action Alternative, TVA would not buy electricity from the Red Hills Power Project and would consider one of the other energy resource options assessed in *Energy Vision 2020* (TVA 1995), and/or the COE would not issue the requested permit. It is possible that a lignite mine and generation facility, selling electricity to some other buyer, could be built at some time in the future. Because of constraints imposed by site conditions and regulations, these facilities could resemble the RHPP components discussed in this EIS, and would have similar environmental impacts. In the absence of such a mine and generation facility development scenario, the No Action Alternative is a continuation of existing conditions and local development trends in the area.

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
4.2 Air Resources	Minor and transient impacts during construction related to land clearing and site preparation (fugitive dust), vehicular traffic, open burning, and internal combustion engine operation would be insignificant and would not lead to violations of any air quality standards. Compliance with air quality permit conditions would assure that air pollutants associated with lignite combustion are not significant. The RHGF stack plume might be visible from the Little Mountain Overlook 25 days/year. Other air quality and visual impacts from facility plumes would be insignificant.	Minor and transient impacts during construction related to land clearing, site preparation, vehicular traffic, open burning, and internal combustion engine operation would be insignificant. Mine operations would have no stationary sources of particulate air emissions. Particulate and exhaust emissions resulting from mining operations would not exceed PSD increments or NAAQS, and are considered insignificant.	Minor and transient impacts during construction related to land clearing, grading, and open burning would be insignificant.
Commitments	• Compliance with applicable federal, state, and local regulations would minimize potential offsite impacts from open burning during construction. • Air emission permit from Mississippi Office of Pollution Control (MOPC) would ensure compliance with all state and federal air quality standards (NAAQS, PSD, NSPS, and NESHAPS).	• Compliance with applicable federal, state, and local regulations would minimize potential offsite impacts from open burning during construction. Operational control measures such as minimizing haul distances, spraying water on roads, and proper reclamation of disturbed areas would reduce the potential for fugitive dust and exhaust emissions.	• Compliance with applicable federal, state, and local regulations would minimize potential offsite impacts from open burning during construction.
4.3 Geology	Loss of sand deposits in the project area would be insignificant. No impacts expected on or from seismicity.	Loss of sand deposits in the project area would be insignificant. Removal of lignite deposits within the 3,800-acre area to be mined represents only a small fraction of the total area over which mineable lignite is present in northeastern Mississippi, and is considered insignificant. Overburden removal would cause a significant change to current stratigraphy. The	No impact.

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
		postmining topography would be similar to original conditions, but with gentler slopes.	
Commitments	• Adherence to seismic provisions of national model building codes.	• Backfilling and grading to replace the overburden would be contemporaneous with mining. The top four feet of selected overburden material would be non-acid forming, non-toxic forming, and non-combustible materials to create a growth medium that is equal to or greater than the native soils.	• None
4.4 Soils	Construction would impact 390 acres, including 44 acres of the Besa Chitto Creek bottomlands. Impacts from construction erosion would be temporary and can be mitigated as described below. Potential impacts on soils from operations from ash management and parking lot/road runoff can be mitigated as described below and are considered insignificant.	Construction would impact 1,900 acres. Operations would impact 3,800 acres over a 37-year period. 1,834 acres are prime farmland soils, but none are classified as historic cropland. Impacts from construction erosion would be temporary and can be mitigated as described below. The truck/shovel fleet would minimize compaction during reclamation, but a ripper would be used where necessary. Potential impacts to soils in mine area would be temporary and can be mitigated as described below. Where soil reclamation results in improved soils, impacts would be beneficial.	Construction would not adversely impact prime farmland soils. Erosion impacts during construction would be temporary and can be mitigated as described below. Localized, permanent soil compaction resulting from construction would be insignificant. Impacts to 14 acres of hydric soils are discussed in Section 4.8, Wetlands.
Commitments	• Use of Best Management Practices (BMPs) such as silt fences, hay bales, and revegetation for erosion control. • Construction of stormwater runoff sumps, and proper revegetation to minimize erosion/sedimentation.	• Use of BMPs such as silt fences, hay bales, settling sumps, runoff diversion structures, sedimentation ponds, and revegetation for erosion control. • The use of selected overburden materials to	• Use of BMPs such as silt fences, hay bales, and revegetation for erosion control.

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)			
Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	• Provision of curbed or diked areas around fuel, oil, and chemical storage facilities. • Use of Spill Prevention Control and Countermeasure (SPCC) Plan.	create a soil productivity level and slope equal to or better than existing conditions. • Provision of curbed or diked areas around fuel, oil, and chemical storage facilities. • Use of SPCC Plan. • Use of appropriate management procedures for stockpile overburden to control leachate and runoff.	
4.5 Groundwater	Shallow groundwater from the Wilcox aquifer would be used for construction purposes. Impacts from these activities are expected to be insignificant. Operations would require 6.33 mgd of makeup-water drawn from the TAS aquifer. Predicted drawdowns in the TAS aquifers would result in small increases in pumping lifts, but no pump modifications. The potential impact of groundwater use on existing and future TAS users, and users of aquifers above the TAS are considered insignificant. The potential for water degradation and possible land subsidence, saltwater encroachment and upconing are considered insignificant.	The effects on groundwater resources from construction activities including groundwater use, excavation, and grading would be insignificant given the limited depth and area of disturbance. 18 wells and springs in and near the mine could be impacted by mine operations; none are public water supplies. These impacts would be mitigated as described below. Impacts of long-term changes in hydraulic properties of the overburden would be insignificant. With the measures described below, acid-forming or toxic materials are not expected to cause significant groundwater quality degradation. No adverse impacts are expected from onsite lignite storage.	No impacts expected from construction. Potential impact from ROW maintenance would be insignificant and can be reduced by the measures listed below.
Commitments	• Use of sumps, trenches, and dewatering pits during facility construction to control groundwater as needed. • Compliance with the MDEQ Water Supply permits issued for operation of wells in the TAS. • Compliance with MDEQ solid waste disposal regulations.	• Provision of alternative water supply by the MLMC to impacted owners. • Use of special handling techniques for unoxidized overburden known to contain AFM or TFM (per mine permit overburden handling plan).	• Use of EPA-registered herbicides labeled for ROW to be applied by licensed personnel, minimizing public exposure and water resource contamination.

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
		• Construction of anoxic limestone drains or addition of buffering agents should acidic seeps occur.	
4.6 Surface Water	The facility would function as a zero discharge facility for process waters. Sanitary wastewater would be discharged into an approved onsite septic system. Stormwater would be collected and routed to ponds as required to prevent contamination. Potential impacts to surface water from facility construction and operation can be reduced as described below and are considered insignificant.	Impacts from mining/ reclamation on the hydrologic system would be small and limited to areas immediately adjacent to the mine excavation. Peak flows in Little and Middle Bywy Creeks could be reduced. Some springs and seeps on the mine site would not return, but the flow from these is insignificant. Potential impacts to water quality/quantity can be reduced as described below and are considered insignificant.	Potential impacts from increased sediment loads and runoff quantities and other construction impacts would be temporary and can be reduced as described below.
Commitments	• Maintenance and compliance with NPDES Permit, SWPP Plan, and SPCC Plan. • Use of BMPs in construction and operations.	• Mine permit calls for construction of sedimentation ponds, stream diversions, and erosion control features to protect local surface waters and hydrologic balance. • Approved surface monitoring program and overburden handling plans would be implemented. • If significant acidic seeps occur, anoxic limestone drains and/or other neutralizing features could be put in place. • Compliance with applicable effluent limitations (NPDES Permit, SWPP Plan, and SPCC Plan). • Reclamation activities including permanent impoundments and restoration of streambeds, and approximate drainage patterns. • Use of BMPs in	• Use of project-specific BMPs and daily work procedures.

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
		construction and operations. • Provision of alternative water supply by the MLMC to owners as needed.	
4.7 Aquatic Ecology	Runoff and sedimentation from construction activities would be insignificant. No adverse impacts are expected from generation facility operations.	Potential runoff and sedimentation from disturbance can be mitigated as described below. Adverse impacts from increased suspended solids and nutrient loading would be short-term and localized. Diversion of onsite streams to new, unshaded channels would temporarily impact aquatic life. This would be somewhat offset by the creation of new habitats in diversion streams and sedimentation ponds in listed mitigation.	There would be temporary impacts during construction associated with erosion and sedimentation. These impacts are not considered to be significant. Impacts to aquatic life from operations and maintenance would be insignificant.
Commitments	• Use of BMPs during construction including fabric filter fences, hay bale dikes, and sedimentation ponds during construction. • Stormwater runoff would be managed in accordance with the SWPP Plan.	• Use of BMPs during construction and operation including fabric filter fences, hay bale dikes, and sedimentation ponds during construction and operation. • Stormwater runoff would be diverted to the mine site sedimentation ponds by diversion ditches or in accordance with SWPP Plan. • Reclamation activities including permanent impoundments and restoration of streambeds, revegetation, and approximate drainage patterns.	• Use of BMPs for utility corridor maintenance and project-specific BMPs and daily work procedures.
4.8 Wetlands	3.58 acres of wetlands would be eliminated during facility construction. This impact can be mitigated as described below. No impacts from operations are expected.	63 acres of wetlands would be eliminated by grading and clearing activities for construction and operation of the mine. However wetland functions would return over time. Additional wetlands	Minor impacts to wetlands during construction would result from clearing of tall vegetation and temporary soil disturbance. Some loss of value of

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
		would be created as a result of mining activities.	impacted wetlands due to conversion from forested to emergent or scrub-shrub wetland types.
Commitments	• Mitigation of wetlands would be in compliance with the COE permit as documented in the individual permit.	• Mitigation of wetlands would be in compliance with the COE permit and in accordance with the mine permit. Additional wetlands would be created.	• Avoidance of wetlands in transmission line routing to the extent possible. • Use of project-specific BMPs and daily work procedures.
4.9 Floodplains	No impact to floodplains are expected to result from either construction or operations of the facility.	Impacts from construction and operation of the mine are expected to be insignificant. Some benefit would be realized due to flood retention capability of sedimentation ponds.	Construction of transmission lines and the natural gas pipeline would temporarily impact the floodplain. No operational impacts are expected.
Commitments	• Adverse floodplain impacts would be minimized through project design and using BMPs during construction.	• By returning affected areas to premining conditions, as provided for in the mine permit, adverse floodplain impacts would be minimized.	• The natural gas pipeline would be constructed completely underground and the impacted area would be returned to pre-construction conditions. • TVA's BMPs would be used for transmission line construction and maintenance. • ROW would be revegetated where natural vegetation is removed.
4.10 Terrestrial Ecology	Loss of common plant communities and animal habitat from the 390-acre site is not expected to have significant impacts to the state or region. Some deep ravine and habitats could be impacted during construction. No significant impact to vegetation is expected from the operation of the facility. Impacts on wildlife from operating noise would be insignificant.	The temporary and/or permanent loss of common plant communities and animal habitat from the 300-acre mine facility construction area is not expected to have significant impact on the state or region. Operation of the mine is expected to destroy most site vegetation. In particular, the uncommon habitats are not expected to reoccur. Except for the uncommon vegetation, the incremental loss of this	No significant impacts would be expected. Maintenance of the transmission lines and natural gas pipeline ROWs would result in the perpetuation of early successional plant communities. This is not expected to have a significant impact to the state or region.

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
		vegetation over the 37-year life span of the mine is not expected to have negative impacts to the vegetation of the state or region. Loss of diversity of habitat may reduce plant and animal species diversity, locally and temporally.	
Commitments	• Facility design features to maintain regulatory noise levels. • Buffering with trees near facility boundaries as required.	• Specific reclamation activities as stated in the mine permit application, guided in-part by landowner preference. This includes creation of habitat diversity. • Efforts would be made to avoid or relocate unique habitats to the extent practicable.	• Use of BMPs for construction. • Establishment of riparian buffer zones along ROW crossing streams.
4.11 Threatened or Endangered Species	Construction and operation of the RHPP would have no effect on federally-listed species or proposed species, since none occur in the area. Loss of the state-listed rare plant population found onsite could be minimized by the mitigation listed.	Construction and operation of the RHPP would have no effect on federally-listed species or proposed species, since none occur in the area. Loss of six state-listed rare plant and three wildlife habitats found onsite could be minimized by the mitigation listed.	Utility corridors would be surveyed for listed species in the Spring of 1998. Based on surveys elsewhere in the area, no federally-listed species are expected to occur.
Commitments	• To the extent practicable transplant the state-listed plant population to a protected area prior to construction.	• Specific reclamation activities as stated in the mine permit application, guided in-part by landowner preference. • Creation of habitat diversity for, and either avoidance or transplantation of, state-listed species to a suitable protected site to the extent practicable.	• Impacts to federally-listed species in corridors would be avoided in final line routing. • Impacts to state-listed species in corridors would be avoided where practicable.
4.12 Land Use	Construction and operation of the generation facility would affect land use on about 390 acres. This would result in conversion of about 322 acres of forestland and 66 acres of pasture and cropland to industrial use, and two acres for other uses. Eleven structures,	Construction and operation of the mine and mine support facilities would affect land use on 5,800 acres over 37 years. 85.3% of the mine area is forestland. About 40 residences and less than 10 other structures would be	Construction and operation of the transmission lines would require the removal of approximately 114 acres of timber valued at $74,000 within the ROW. Construction of the

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	including five residences, and three small ponds could be removed. Indirect impacts include business and housing development which would likely occur if the project proceeds. However, this development is expected to be limited.	removed. Impacts would last for at least eight to nine years from initial clearing activity through reclamation and final bond release. This represents a short-term potential income loss to the landowner. However, the landowner would receive mineral royalties and surface damage payments. (See Socioeconomic Section.) The mine permit application identifies a number of mitigation measures that the mine operator would implement. The impact on the value of timber resources would be beneficial, with an estimated increase in net future value of $45/acre.	natural gas pipeline, which follows the transmission line ROW, would require an additional 75 feet at the edge of the ROW. Most land uses could resume after construction except for forestry along the utility ROW. Operational impacts from the utility lines would result in long-term but regionally insignificant reductions of forestland.
Commitments	• None	• Mining regulations require that the soil productivity of reclaimed areas be at least equal to or greater than prior to mining. • The mine permit application calls for reclamation activities that would restore land to the land use choice of the surface landowner. However, the majority of the proposed postmining land use has been designated as commercial forestry, interspersed with fish and wildlife features. • Some recreational land use could be created due to the possible permanent retention of the water control pond.	• None
4.13 Cultural and Historic Resources	No adverse impact expected from construction or operation. No historic or archeological sites listed or eligible for inclusion on the National Register of Historic	The first five years of mine activities could impact seven archeological sites potentially eligible for the National Register of Historic Places.	After the utility corridors are identified, they would be surveyed and the results reported in the FEIS. In coordination

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	Places occur in the vicinity. Ambient air emissions from facility operations are not expected to adversely impact downwind historic structures.	Later mine activities could impact one cemetery.	with the MSHPO, any adverse impacts would be mitigated as indicated.
Commitments	• None	• Any sites determined to be eligible for the Register would either be avoided or any adverse impacts would be mitigated. Mitigation would consist of Phase III data recovery as approved by MLMC, TVA, MSHPO, and the Advisory Council on Historic Preservation as detailed in the proposed Programmatic Agreement (PA). • Surveys would be conducted for any areas to be disturbed outside of the five-year mine area, also as provided for in the PA. • The cemetery would be avoided.	• Any sites determined to be eligible for the Register would either be avoided or any adverse impacts would be mitigated.

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
4.14 Socioeconomics	Employment during construction would average 750, with a three-month peak employment of 1,500. An estimated one-half of the 750 workers would commute; the rest would move within commuting range. RHGF would employee 39 workers. These projected increases are expected to have an insignificant impact on housing, water supply, sewer, health facilities, and crime. Impacts would be beneficial to local government revenues and land values. Two school systems, some fire protection services, and some local law enforcement systems may experience temporary impacts during construction.	Employment during construction would average 112, with a five-month peak employment of 150. An estimated one-half of the workers would commute, the rest would move within commuting range. Mine operation employment would average 131. These projected increases are expected to have an insignificant impact on housing, water supply, sewer, health facilities, and crime. Impacts would be beneficial to local government revenues and land values. Two school systems, some fire protection services, and some local law enforcement systems may experience locally significant impacts.	No impacts are expected.
Commitments	• Work with the area advisory groups to determine how best to mitigate any impacts. • Where practicable, hire local employees and make local procurements. • Would implement safety training programs. • Permit available water supply for fire protection onsite. • Would provide fire training programs to facility employees.	• Where practicable, hire local employees and make local procurements. • MLMC would implement extensive safety training programs. • MLMC would provide EMT training to mine employees. • Permit available water supply for fire protection. • MLMC would provide extensive fire training programs to mine employees.	• None
4.15 Environmental Justice	The proportion of minority, lower income, and aged population are all less in the project area than in Choctaw County and/or in the State. Therefore no impact is expected.	The proportion of minority, lower income, and aged population are all less in the project area than in Choctaw County and/or in the State. Therefore, no impact is expected.	The proportion of minority, lower income, and aged population are all less in the project area than in Choctaw County and/or in the State. Therefore, no impact is expected.
Commitments	• None	• None	• None
4.16 Transportation	Impacts to rail or air transportation would be insignificant. Traffic	Impacts to rail or air transportation would be	Impacts of construction of the natural gas pipeline

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	impacts from operations would be insignificant with only slight reductions in levels of service on nearby roads. Impacts from annual maintenance outages would be short-term and transitory. During peak construction periods, levels of services would be more substantially impacted but this would be temporary.	insignificant. Impacts to roads from construction and operation would be insignificant. Mine operations would result in closing and/or relocating several county roads over the life of the mine. During peak construction periods, levels of services would be more substantially impacted but this would be temporary.	on local roadways would be temporary and could be mitigated as indicated below. Impacts from construction and maintenance of the transmission lines would be insignificant.
Commitment	• Stage delivery of large equipment during non-peak traffic hours. • Control traffic as required. • Discourage employees from commuting on Natchez Trace Parkway. • No truck deliveries via Natchez Trace Parkway.	• Road closure and alteration plans would be reviewed by the Choctaw Co. Board of Supervisors for approval. • Public roads would be reconstructed in their original location or a more suitable location as approved by the county. All roads would be rebuilt to existing standards or better. • Surface owners would retain access to lands, although access to land being mined would be controlled by MLMC for safety purposes. • Discourage employees from commuting on Natchez Trace Parkway. • No truck deliveries via Natchez Trace Parkway.	• Construction of the natural gas pipeline would be overseen by the MS Public Service Commission Division of Pipeline Safety to minimize any possible impacts.
4.17 Public Health	For construction, limited impacts are expected on emergency medical response. No operational impacts are expected on emergency medical response. Two hazardous materials would be present during operations—gaseous chlorine and natural gas. These present limited potential for adverse impacts for toxic gas or vapor release. Radiological impacts of operations are insignificant.	For construction, limited impacts to emergency medical response. For operations, limited impacts to emergency medical response and from air pollutants are expected.	No impacts to public health through increased exposure to EMF or impacts to emergency medical response are anticipated.
Commitments	• Coordinated emergency medical	• Coordinated emergency	• None

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	services planning. • Compliance with NAAQS regulations.	medical services planning.	
4.18 Hazardous and Solid Waste	Only limited quantities—less than 220 lbs/month—of hazardous waste would be generated during construction and operating phases of the generation facility. The risks associated with these wastes can be lessened as described below. Potential Impacts from non-hazardous solid waste (notably ash) are not expected to be important and can be reduced by the measures listed below.	Only limited quantities—less than 220 lbs/month— of hazardous waste would be generated during construction and operation phases of the lignite mine. The risks associated with these wastes can be lessened as described below.	No impacts from hazardous waste or solid waste are expected.
Commitments	• Use of strict chemical storage and safety programs. • Compliance with applicable OSHA regulations. • Registration with EPA as a Conditionally Exempt Small Quantity Generator or Small Quantity Generator. • Manage hazardous waste in accordance with applicable RCRA regulations. • Design and construction of ash management unit in accordance with MDEQ permit. • Maximize beneficial use of ash. • Implementation of applicable Pollution Prevention Plan.	• Use of strict chemical storage and safety training programs. • Registration with EPA as a Conditionally Exempt Small Quantity Generator or Small Quantity Generator. • Hazardous waste would be managed in accordance with applicable RCRA regulations. • Implementation of the mine permit application requirements for waste management. • Implementation of applicable Pollution Prevention Plan.	• Proper disposal of all wastes.
4.19 Noise	No hearing loss or speech intelligibility impact on residents from noise is expected during construction or operations. Other impacts from noise are expected to be insignificant.	No hearing loss or speech intelligibility impact on residents from noise is expected during construction or operations. Other impacts from noise are expected to be insignificant.	No hearing loss or speech intelligibility impact on residents from noise is expected during construction. Other impacts from noise are expected to be insignificant. Impacts from maintenance of transmission line and natural gas pipeline corridors is expected to be local, short-term, and insignificant.

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
Commitment	• Limit construction activity as much as practicable to the daytime hours. • Design generation facility features to maintain regulatory noise levels. • Buffer with tree plantings near facility boundaries as required.	• Design activities to minimize noise to extent practical.	• None
4.20 Recreation	No loss of general public recreation opportunities would occur, because all property is privately owned. Impacts to general public recreation from permanent employees would be insignificant. Construction and operational impacts on hunting clubs would be insignificant. The sights and sounds of construction could impact recreation, but such impacts can be mitigated as described below.	No loss of general public recreation opportunities would occur, because all property is privately owned. Construction and operational impacts on hunting clubs would be insignificant. The sights and sounds of construction could impact recreation, but such impacts can be mitigated as described below. Recreational uses would improve if water control ponds are retained after mining.	No impacts.
Commitments	• As listed in Sections 4.19 and 4.21.	• As listed in Sections 4.19 and 4.21.	• None
4.21 Visual Resources	Some significant impacts—lighting and destruction of vegetation—from construction and operation would occur. These impacts would be localized and temporary. These potential impacts can be mitigated as described below.	Some significant impacts—lighting and vegetation removal—from construction and operation of the mine would occur. These potential impacts can be mitigated as described below. There would be few long-term visual impacts from the mine operation.	Clearing the ROW for the transmission lines and natural gas pipeline would impact the visual landscape.
Commitments	• Commit to use "dark sky" lighting as practical. Use shielded low-pressure sodium lighting. • Minimize installation of lighting fixtures. • Implement operational plans that minimize lighting. • Use dual stack lighting system in accordance with FAA Advisory Circular AC 70/7460-IJ. • Retain dense vegetative buffer around the ash management	• Commit to use "dark sky" lighting. • Mine reclamation activities as detailed in the mine permit, including: ◊ Work with the NPS on management of foreground vegetation along Parkway. ◊ Control discharges to achieve no perceptible difference in water	• After construction, the transmission lines and structures would affect a permanent change in visual landscape. • Maintenance of both the transmission line and natural gas pipeline ROW would add to the visual impact.

Table 2.3-1 Summary of Effects of Proposed Action (Commitments include permits, licenses, and agreed upon mitigation)

Resource/ Commitments	Red Hills Generation Facility	Red Hills Lignite Mine	Transmission Line and Natural Gas Pipeline
	unit. • Use flat color in the medium cool-gray range for the exterior of the facility. • Use of tree plantings and landscaping to minimize impacts around facility.	quantity or quality under the Parkway. ◊ Control fugitive dust emissions with two 12,000-gallon water trucks. ◊ Train employees to be sensitive while working near Parkway. • 2,000-foot set back of lignite recovery operations from the Natchez Trace Parkway to provide vegetation screening. • Keep the dragline low in the pit to limit its visibility.	

2.4 The Preferred Alternative

TVA's preferred alternative is to purchase the electricity generated by the Red Hills Power Project and to construct the connecting transmission line within Corridor A. The generation facility would be built and operated by Choctaw Generation Inc., as described in Section 2.2.1. The mine would be built and operated by Mississippi Lignite Mining Company, as described in Section 2.2.2. The natural gas pipeline would be built and operated by the Town of Weir, as described in Section 2.2.4.

By selecting this alternative, TVA would fill a portion of its need for a new, competitively-priced supply of electricity. The location of the project, in the southwestern portion of TVA's power service area, would also help reduce transmission line losses to this region of rapidly increasing electrical demand. In addition, the project would result in significant local socioeconomic benefits and acceptable environmental impacts.

The U.S. Army Corps of Engineers does not have a preferred alternative action.

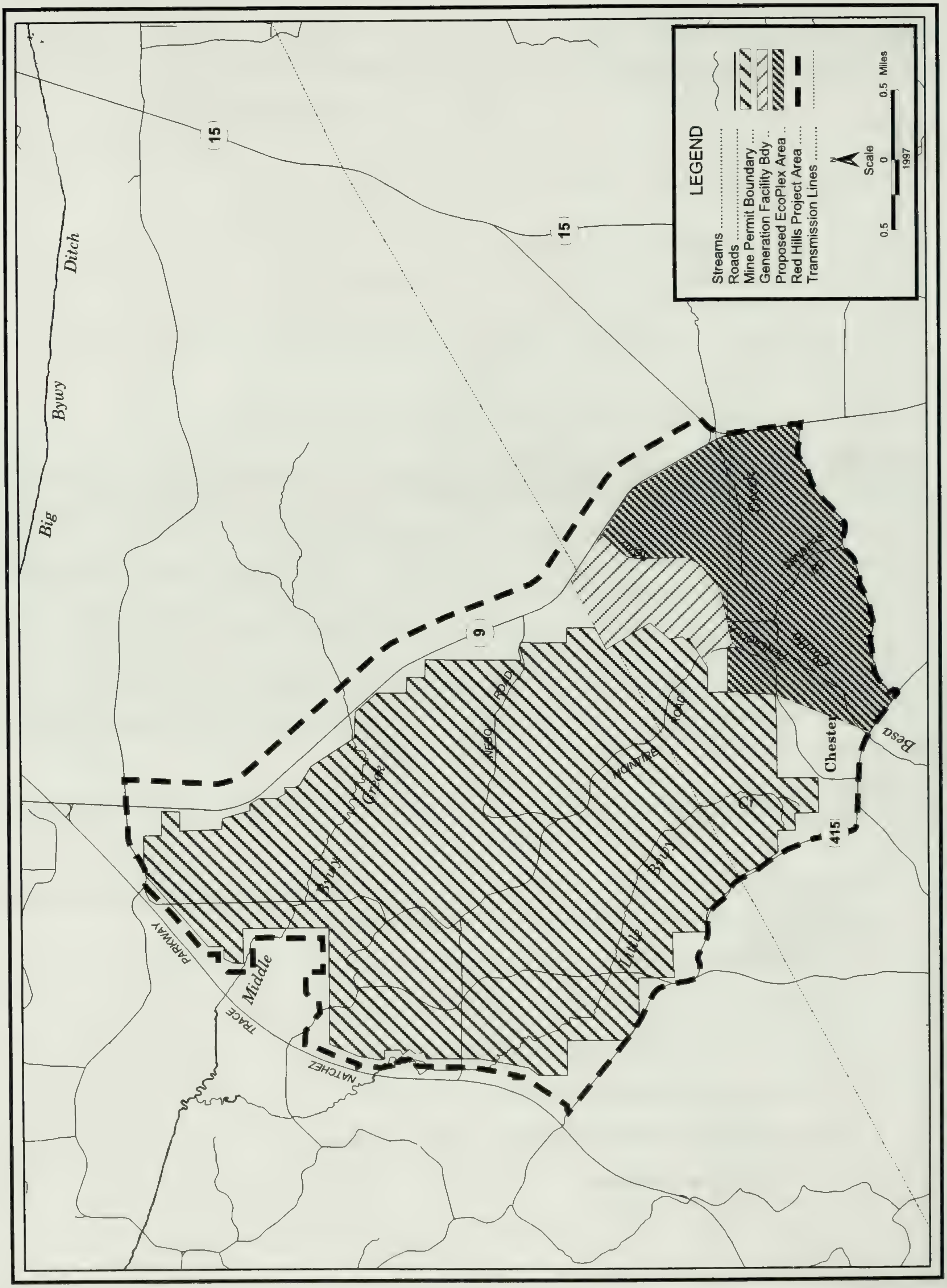
2.5 The Red Hills EcoPlex Industrial Park

Choctaw County, with assistance from the state of Mississippi, plans to develop the Red Hills EcoPlex industrial park near the generation facility. The EcoPlex would combine various manufacturing businesses at a common location to help achieve the highest levels of efficiency in terms of energy consumption and joint feedstock/waste utilization. Industries locating in the EcoPlex would use steam, carbon dioxide, and/or ash from the generation facility, as well as byproducts from other EcoPlex tenants, in their manufacturing processes. The Red Hills area was chosen for EcoPlex development because of the opportunities to leverage the planned generation facility project into a larger development opportunity for Choctaw County and the surrounding region.

Figure 2.5-1 depicts the proposed location of the Red Hills EcoPlex. The following criteria were used by Choctaw County and the state of Mississippi in selecting this site:

- proximity to the generation facility, for efficient exchange of steam and other products and to minimize construction of access roads and utility connections;
- relatively flat topography, to minimize site preparation costs;
- absence of environmental contamination from previous land uses;
- minimal impacts from flooding and to downstream flood control;
- proximity to existing roads and railroads;
- proximity to existing water and natural gas supply systems; and
- number of existing landowners.

Figure 2.5-1 Proposed EcoPlex industrial park area.



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

The proposed EcoPlex industrial site would be about 1,500 acres in size. About 500 acres would be available during the initial development phases. When fully occupied by tenants, about 1,000 acres of the site would be developed.

Based on the results of a Master Plan prepared for the state of Mississippi by Mississippi Energy Consultants with the assistance of Arthur Andersen (Arthur Andersen 1997), the industries listed below are being recruited as early tenants of the EcoPlex.

- Greenhouse – Two types of greenhouse operations are likely EcoPlex tenants. One type is hydroponic gardening, also known as controlled-environment agriculture. This operation would grow high-value crops such as tomatoes, lettuce, cucumbers, and herbs, with the plant roots suspended in a liquid nutrient solution or in a synthetic soil substitute such as perlite. The other type is a more traditional greenhouse operation, growing potted ornamental indoor plants, flowers, and vegetable seedlings. Both greenhouse types could use carbon dioxide from the generation facility exhaust stack to stimulate plant growth and use steam from the facility for winter heating.
- Aquaculture – This operation would raise fish, most likely tilapia, in enclosed tanks heated by steam from the facility. Tilapia are members of the perch family native to Africa. The aquaculture operation would be integrated with the hydroponic gardening operation and water would circulate through the tanks of the two operations. The aquaculture operation would likely cover at least two acres and raise at least 560,000 lbs of fish per year. Other species which could potentially be raised in this aquaculture operation are catfish, freshwater shrimp, crappie, and hybrid bream.
- Kenaf Pulp Mill – This operation would process pulp from kenaf. Kenaf is an annual plant native to east-central Africa, closely related to cotton and okra, and easily cultivated in Mississippi. A kenaf pulping operation would likely use a zero effluent thermo-mechanical process because of the water supply and discharge limitations of the Red Hills area. A likely end use of the kenaf pulp is manufacturing fiberboard panels. Other potential end products include particleboard panels and paper. The pulping operation would likely use steam from the facility. The end product manufacturing operation could be located outside of the EcoPlex; if in the EcoPlex, it would be a potential user of steam from the generation facility.

The anticipated resource requirements of the EcoPlex tenants are shown in Table 2.5-1. The EcoPlex totals shown in the table are based on three combined greenhouse-aquaculture operations and a single kenaf mill.

Table 2.5-1 Anticipated Resource Requirements of Early EcoPlex Tenants [Sources: Arthur Andersen (1997), Forsythe (1997)]

Resource	Greenhouse	Aquaculture	Kenaf Pulp Mill	EcoPlex Total[1]
Facility Size	25-100 greenhouses	560,000 lbs. of fish/year	50,000 tons/year	--
Land (acres)	12-60	3	50	200
Employment (jobs)	40-100[2]	10-20	120	270-480
Electricity (MW/day)	0.5-1	<0.5	10-20	12-25
Water Supply (MGD)	minimal	minimal	0.5	0.5
Steam (pph)	yes	yes	yes	--
Wastewater (MGD)	minimal	minimal	minimal	--
Biomass Waste (tpy)	sold as compost	--	10,000	10,000
Road and Rail Access Requirements	road	road	road; rail desirable	road; rail desirable

[1]Totals based on 3 greenhouse operations, 3 aquaculture operations, and 1 kenaf mill.
[2]Higher number includes seasonal workers.

The Arthur Andersen report (Arthur Andersen 1997) also recommended that a poultry processing operation be recruited as an early EcoPlex tenant. The EcoPlex developers, however, do not plan to recruit a poultry processing operation.

Earlier discussions of the proposed EcoPlex (e.g., TVA 1996b) identified pulp and paper manufacturing and industries using gypsum, such as wallboard manufacturers, as likely tenants. Based on the analysis in the Master Plan, a large-scale pulp and/or paper mill is not currently contemplated because of the area's limited ability to assimilate the waste stream. The CFB technology to be used in the proposed generation facility does not produce gypsum of wallboard quality, and the fly ash produced by the proposed facility is not a suitable substitute. An industry using gypsum is therefore unlikely to locate in the EcoPlex. Other industries using ash, however, are potential later tenants.

2.6 National Geodetic Survey

TVA has accessed the electronic information for geodetic control information on the National Geodetic Survey (NGS) home page. This information was plotted on maps of the proposed project. These maps were then reviewed for any planned activities that would disturb or destroy monuments. No planned activities for the proposed generation facility, proposed 37-year life of mine, proposed transmission line corridors, or proposed EcoPlex will disturb or destroy any monuments listed in the NGS data base.

3. AFFECTED ENVIRONMENT

3.1 Introduction

This chapter describes the present environmental and socioeconomic conditions of the Red Hills Power Project (RHPP) study area. This information provides a baseline for understanding the consequences of the proposed alternative actions described in Chapter 2 and evaluated in detail in Chapter 4. The overall project area is illustrated in Figure 1.1-1. However, the geographic scope of the various resource descriptions differs between resource areas; the area considered in the air quality descriptions, for example, is larger than the area considered in the soils descriptions.

The existing environment and conditions are described in detail for the resources listed below:

Air Resources	Geology
Soils	Groundwater Resources
Surface Water	Aquatic Ecology
Wetlands	Floodplains
Terrestrial Ecology	Threatened or Endangered
Land Use	Cultural and Historical Resources
Socioeconomics	Environmental Justice
Transportation	Public Health
Hazardous and Solid Waste	Noise
Recreation	Visual Resources

3.2 Air Resources

The following sections describe the existing environmental conditions relevant to air quality at the proposed site of the RHPP and the surrounding area. These conditions include the climatology and meteorology, ambient air quality, and existing emissions sources.

3.2.1 Climatology and Meteorology

The climate of the project area in Choctaw County, Mississippi, varies seasonally with a warm, humid summer and a generally mild, humid winter. Hot spells with maximum temperatures above 90°F for several consecutive days occur during most summers, but heat waves with maximum temperatures of 95°F to 100°F, or more, for several days are infrequent. While mild conditions prevail in the winter, temperatures can drop to near 0°F. Such cold spells are rarely lengthy. Spring and fall feature moderate but changeable weather as part of the annual transition from summer to winter and back to summer.

Tables 3.2.1-1 through 3.2.1-5 provide basic climate information for the Red Hills area. The nearest weather station is at Ackerman (National Climatic Data Center 1996a), between five and ten miles south-southeast of the project area. Information from the Ackerman station is very limited, so

Tables 3.2.1-1 through 3.2.1-5 include data from other stations thought to be reasonably representative of the Red Hills area. The additional data sources are Eupora 2E (National Climatic Data Center 1996a), almost ten miles north of the project area; the Jackson Weather Service Forecast Office (National Climatic Data Center 1996b), about 90 miles southwest; Columbus Air Force Base (National Climatic Data Center 1995), nearly 50 miles east-northeast; a climatic atlas (U.S. Department of Commerce 1968); a fog frequency study (Hardwick 1973); a study of mixing heights (Holzworth 1972); and a study of stagnating high pressure systems (Korshover 1971). Temperature and precipitation normals given in the tables are averages for the current standard 30-year climatic reference period of 1961 to 1990.

Temperature extremes for the periods of record given in parentheses include -2°F and 106°F (1942 to 1946 and 1958 to 1993) for Columbus Air Force Base (National Climatic Data Center 1995) and 2°F and 106°F (1965 to 1995) for Jackson Weather Service Forecast Office (National Climatic Data Center 1996b), with -5°F in 1940 and 107°F in 1930 in the Jackson area (National Climatic Data Center 1980).

Precipitation extremes observed at the Columbus station and the Jackson station in the same periods of record include 6.65 inches in 24 hours and 16.20 inches in one month for Columbus (National Climatic Data Center 1995) and 8.42 inches in 24 hours and 17.70 inches in one month for Jackson (National Climatic Data Center 1996b). According to Weather Bureau Technical Paper No. 40 (Hershfield 1961), a given location in the project area can expect a 1-hour rainfall of about 3.2 inches once in 50 years, a 1-hour rainfall of about 3.6 inches once in 100 years, a 24-hour rainfall of about 6.2 inches once in 10 years, a 24-hour rainfall of about 8.0 inches once in 50 years, and a 24-hour rainfall of about 8.8 inches once in 100 years.

Table 3.2.1-1 Existing Climate - Temperatures in the RHPP Area

	Temperature (°F)						
	Means			Average Maximum		Average Minimum	
	Eupora 2E 1961-90	Columbus AFB 1942-46; 1958-93	Jackson WSFO 1961-90	Columbus AFB 1942-46; 1958-93	Jackson WSFO 1961-90	Columbus AFB 1942-46; 1958-93	Jackson WSFO 1961-90
Jan	42.5	43	44.1	52	55.6	33	32.7
Feb	46.8	47	47.9	57	60.1	37	35.7
Mar	55.3	55	56.7	65	69.3	44	44.1
Apr	63.2	63	64.6	75	77.4	52	51.9
May	70.4	71	72.0	81	84.0	60	60.0
Jun	77.1	78	78.8	88	90.6	68	67.1
Jul	79.9	81	81.5	91	92.4	71	70.5
Aug	78.9	80	80.9	90	92.0	70	69.7
Sep	73.6	75	75.9	85	88.0	64	63.7
Oct	62.7	63	64.7	75	79.1	51	50.3
Nov	53.8	54	55.8	64	69.2	42	42.3
Dec	45.9	45	47.8	55	59.5	36	36.1
Annual	62.5	63	64.2	73	76.4	52	52.0

Table 3.2.1-2 Existing Climate - Precipitation in the RHPP Area

	Precipitation (in.)				Average Snowfall (in.)
	Eupora 2E 1961-90	Ackerman 1961-90	Columbus AFB 1942-46; 1958-93	Jackson WSFO 1961-90	Columbus AFB 1942-46; 1958-93
Jan	5.44	5.24	5.09	5.24	1.1
Feb	4.87	4.75	5.17	4.70	0.5
Mar	6.48	6.05	6.24	5.82	0.3
Apr	5.68	5.63	5.82	5.57	Trace
May	4.66	4.50	5.31	5.05	0
Jun	3.78	3.92	3.49	3.18	0
Jul	4.65	4.78	4.48	4.51	0
Aug	3.03	3.04	3.71	3.77	0
Sep	3.56	4.07	3.64	3.55	0
Oct	3.80	3.73	3.31	3.26	0
Nov	4.63	4.48	4.56	4.81	Trace
Dec	6.21	6.10	5.80	5.91	0.4
Annual	56.79	56.29	56.79	55.37	2.1

Table 3.2.1-3 Existing Climate - Wind Conditions and Precipitation, Thunderstorm, and Fog Frequency in the RHPP Area

	Prevailing Wind Direction		Average Wind Speed (mph)		Avg. Number Days w/Precip ≥ 0.01 in.		Avg. Number Thunderstorm Days		Avg. Number Heavy Fog Days	
	Columbus AFB 1983-93	Jackson WSFO 1964-95	Columbus AFB 1983-93	Jackson WSFO 1965-95	Columbus AFB 1942-46; 1958-93	Jackson WSFO 1968-95	Columbus AFB 1942-46; 1958-93	Jackson WSFO 1965-95	Jackson WSFO 1965-95	Hardwick Study in 1973
Jan	N	360 (N)	5.8	8.2	11	10.8	2	1.9	3.4	3
Feb	N	340 (NNW)	5.8	8.4	10	9.3	3	2.7	2.1	2
Mar	S	180 (S)	5.8	8.9	11	10.1	5	5.5	1.7	2
Apr	SSE	160 (SSE)	4.6	8.2	9	8.3	6	5.6	1.5	1
May	SSE	140 (SE)	4.6	7.1	9	9.4	7	7.2	1.0	1
Jun	SSE	180 (S)	3.5	6.3	9	8.2	9	8.9	0.7	1
Jul	S	180 (S)	3.5	5.8	11	10.3	12	12.6	1.2	1
Aug	N	140 (SE)	3.5	5.4	9	9.5	9	10.5	1.5	1
Sep	N	140 (SE)	3.5	6.0	8	8.3	5	5.2	1.5	2
Oct	N	140 (SE)	3.5	6.1	7	5.9	2	2.1	2.3	2
Nov	SSE	150 (SSE)	5.8	7.1	9	8.1	2	2.6	2.3	2
Dec	N	140 (SE)	5.8	8.0	11	10.1	2	2.4	3.3	2
Annual	N	140 (SE)	4.6	7.1	114	108.3	64	67.2	22.5	20

Table 3.2.1-4 Existing Climate - Dewpoint and Humidity Conditions in the RHPP Area			
	Mean Dewpoint Temperature (°F)	Mean Wet Bulb Temperature (°F)	Average Relative Humidity (%)
	Jackson WSFO 1962-90	Jackson WSFO 1962-90	1968 Climatic Atlas
Jan	36.5	41.1	75
Feb	38.5	43.5	75
Mar	45.9	51.1	70
Apr	54.0	58.6	70
May	61.7	65.3	70
Jun	68.2	71.4	70
Jul	71.5	74.1	75
Aug	70.8	73.4	75
Sep	66.1	69.0	70
Oct	54.4	58.5	70
Nov	47.0	51.2	70
Dec	40.0	44.4	75
Annual	54.6	58.5	70

Table 3.2.1-5 Existing Climate - Mixing Height and Stagnation Conditions in the RHPP Area					
	Winter	Spring	Summer	Fall	Annual
Average Mixing Height (m)					
Morning	450	450	400	300	400
Afternoon	1100	1600	1800	1400	1500
Number of Atmospheric Stagnation Cases ≥ 4 Days					
Total Number for 1936-1970	1	8	12	24	45

Maximum 24-hour and 1-month snowfalls of 7.3 inches and 11 inches at Columbus Air Force Base for the years 1942 to 1946 and 1958 to 1993 (National Climatic Data Center 1995) show the minor influence of snow in the project site area. However, extreme snowfalls include the 24-hour and also the single storm amount of 18 inches, at both Tunica and Mt. Pleasant in northern Mississippi in 1963, and 11.7 inches for both the 24-hour period and a single storm at Jackson in 1904 (Ludlum 1970).

During the period from the beginning of 1950 through October 1996, Choctaw County experienced six tornadoes (National Severe Storms Forecast Center 1994; National Climatic Data Center 1994-1996). The remains of tropical storms or hurricanes caused destruction in the project site area about four times during the 1901 to 1955 period (Sanders 1959). Such destruction is mainly from flooding but can include some wind damage, usually to trees after heavy rain has loosened the soil around roots. Extreme straight wind speeds of about 70 mph at 30 ft above ground are calculated to occur once in 100 years (Thom 1968), but would almost certainly be caused by thunderstorms. Large hail has been reported in Choctaw County, but is infrequent. For example, in the 13-year period of 1955 to 1967 only six reports

of localized hail ¾-inch diameter or larger were recorded in the one degree latitude by one degree longitude square (about 60 miles by 60 miles) containing the county (Department of Commerce 1969).

Air pollutant concentrations resulting from a given emission rate can vary significantly according to atmospheric dispersion conditions. Seasonal variations in dispersion conditions include more stagnation of air masses in the summer and fall (as indicated in Table 3.2.1-5), and lower average wind speeds in summer and early fall (as indicated in Table 3.2.1-3). Figures C-1.1 through C-1.5 in Appendix C-1 depict long-term patterns of wind direction and wind speed frequencies for the Jackson Weather Service Forecast Office location (National Climatic Data Center 1993), which is the most representative source of long-term wind data for the project site area.

3.2.2 Ambient Air Quality

Air quality is important in protecting human health and natural resources. The EPA has established national ambient air quality standards for the six criteria pollutants listed below:

- sulfur dioxide (SO_2);
- ozone (O_3);
- nitrogen dioxide (NO_2);
- carbon monoxide (CO);
- PM_{10} and $PM_{2.5}$ particulate; and
- lead.

In addition, Mississippi has an ambient standard for Total Suspended Particulates (TSP). Pollutant concentrations are established for two classes of effects: primary and secondary. Primary standards are for the protection of public health, while secondary standards protect public welfare (e.g., visibility, aquatic ecosystems, crops and forests, soils, materials). Current standards are shown in Table 3.2.2-1.

Table 3.2.2-1 National Ambient Air Quality Standards

Pollutant	Primary*	Secondary**
Sulfur Oxides (Sulfur Dioxide)	0.14 ppm (365 μg/m^3) maximum 24-hr concentration not to be exceeded more than once per year. 0.03 ppm (80 μg/m^3) annual arithmetic mean.	0.5 ppm (1300 μg/m^3) maximum 3-hr concentration not to be exceeded more than once per year.
Ozone (Old)***	0.12 ppm maximum 1-hr concentration with an expected exceedance of no more than one day per year based upon a 3-yr average.	Same as primary standard.
Ozone (New)	0.08 ppm based on the average of the fourth highest daily maximum 8-hr concentration during each ozone season (currently April 1 - October 31) for each of three consecutive years.	Same as primary standard.
Nitrogen Dioxide	0.053 ppm (100 μg/m^3) annual arithmetic mean.	Same as primary standard.
Carbon Monoxide	35 ppm (40 mg/m^3) maximum 1-hr concentration not to be exceeded more than once per year. 9 ppm (10 mg/m^3) maximum 8-hr concentration not to be exceeded more than once per year.	None.
$PM_{2.5}$ (New Std.)	15 μg/m^3 annual average.	50 μg m^3 (24-hr average).
PM_{10}	150 μg/m^3 maximum 24-hr concentration with an expected exceedance of no more than one per year based upon a 3-yr average. 50 μg/m^3 annual arithmetic mean.	Same as primary standard.
Lead	1.5 μg/m^3 maximum quarterly arithmetic mean.	Same as primary standard.

* Standards set to protect public health.
** Standards set to protect public welfare.
*** Only applicable in areas not attaining the standard prior to September 16, 1997.

National standards, other than annual standards, are not to be exceeded more than once per year (except where noted). Units are parts per million (ppm) by volume of air except for particulate matter which is expressed in micrograms per cubic meter (μg/m^3). The ozone standard is attained if the three-year average of the annual fourth highest eight-hour (any sequential eight hours a day) concentration is no higher than 0.084 ppm.

The ambient air quality of the proposed RHPP area was monitored from mid-October 1996 through October 1997 at a site near Ackerman, Mississippi. This monitoring was conducted in accordance with EPA and MDEQ regulations and guidelines and followed a monitoring plan approved by MDEQ. Ambient air concentrations of the six criteria pollutants listed above were monitored.

The results of this monitoring and the current air quality standard for these pollutants are listed in Table 3.2.2-2. Concentrations of all six pollutants were significantly below applicable standards. Ambient concentrations of five of the criteria pollutants (all but O_3) were only 2 to 49% of the levels of applicable standards. Ambient ozone measured at the Ackerman site was about 89% of the ozone standard. These data are graphically illustrated and compared with standards in bar graphs in Appendix C-2 in Figures C-2.1 through C-2.6.

Table 3.2.2-2 Ambient Concentrations of Criteria Air Pollutants Compared with Air Quality Standards: RHPP PSD Monitoring Nov. 1, 1996 - Oct. 31, 1997			
		One-Year Maximum or Mean	
Pollutant	Level of Standard (ppm)	Concentration (ppm)	Percent of Standard (%)
Ozone (Old Std.)	Max. 1-hr Avg. (0.12)	0.087	73
Ozone (New Std.)	4^{th} Highest 8-hr Avg. (0.08)	0.071*	89
Sulfur Dioxide	Max. 3-hr Avg. (0.5)	0.017	3
	Max. 24-hr Avg. (0.14)	0.008	6
	Annual Mean (0.030)	0.002	7
Nitrogen Dioxide	Annual Mean (0.053)	0.004	8
Carbon Monoxide	Max. 1-hr Avg. (35)	1.780	5
	Max. 8-hr Avg. (9)	1.279	14
	($\mu g/m^3$)	($\mu g/m^3$)	
PM_{10}	Max. 24-hr Avg. (150)	73	49
	Annual Mean (50)	21.7	43
Lead	Quarterly Mean (1.5)	0.028**	2

* Fourth highest eight-hour average.
** Maximum quarterly mean.

In addition to the air quality data collected in close proximity to the RHPP site, an inspection of air quality data from two other regional locations, which effectively represent the regional air quality, also support the conclusion that air quality is generally good (Table 3.2.2-3).

Table 3.2.2-3 Summary of Ambient Air Quality Monitoring Results and Estimated Background Air Quality For Criteria Pollutants				
Pollutant	Averaging Period	MDEQ Estimate[a]	Coffeeville, MS Station[b]	Oak Grove, MS Station[d]
NOx (ppb)	Annual	7.3	-	-
NOy[e] (ppb)	Annual	-	-	7.9
SO_2 (ppb)	Annual	3.8	1.3	2.3
	3-hour	3.8	-	49
	24-hour	3.8	-	14
PM_{10}[f] ($\mu g/m^3$)	Annual	22	-	-
	24-hour	50	-	-
CO (ppb)	1-hour	87.5	-	-
	8-hour	87.5	-	-
Ozone (ppb)	1-hour	N/A	99[c]	95[c]

[1] ppb = 0.001 ppm
[a] MDEQ estimates provided by the Office of Pollution Control (Alrawi 1996) based on analysis of available information.
[b] Coffeeville Station results for 1990 to 1992, published by U.S. EPA (1995).
[c] Ozone level reported is the highest second-highest concentration monitored during the period 1990 to 1992 (Coffeeville) and 1993 to 1995 (Oak Grove).
[d] Oak Grove Station data for 1993 to 1995, provided by EPA subcontractor responsible for data management (ESE 1996).
[e] NOy = NOx + HNO_3 + PAN + NO_3 + organic nitrates.
[f] Particulate matter less than or equal to 10 microns.

The two additional locations used were:

- Coffeeville, Mississippi – This station is part of EPA's National Dry Deposition Network (NDDN), which, in turn, is part of the Clean Air Status and Trends Network (CASTNet) and the National Atmospheric Deposition Program (NADP). The station is located approximately 51 miles north-northwest of Ackerman in a forested area with rolling terrain. The Coffeeville station monitors O_3 and meteorological data continuously at an elevation of 10 m above the ground. Atmospheric SO_2 and nitrogen species are sampled on weekly intervals. The most recently published report on the results of the CASTNet/NDDN/NADP network (USEPA 1995a) summarizes the SO_2 and O_3 data obtained from this station in 1990 to 1992.

- Oak Grove, Mississippi - This station is operated as part of the Southern Oxidants Study (SOS) Southeast Consortium Intermediate Ozone Network (SCION). The purpose of this network is, among other things, to develop an understanding of O_3 and O_3-precursor climatology at regionally representative sites across the southeast. The Oak Grove station is located approximately 162 miles south of the proposed RHPP site in rural Perry County, Mississippi. The monitoring station is in the DeSoto National Forest and is operated as a state-of-the-art regional background monitoring station that maintains a long-term database for O_3, SO_2, NO, total nitrogen oxides, CO, and VOCs. All sampling is conducted at a standard elevation of 10 m (3.3 ft) above ground level. The data from the Oak Grove station are currently available for 1993 to 1995 (ESE 1996).

These data, along with the air monitoring data collected at the Red Hills site over the past year (Nov. 1, 1996 to Oct. 31, 1997) suggest that present conditions for all criteria pollutants, except O_3, are not likely to approach the levels of ambient standards. There were no $PM_{2.5}$ data collected but the data show that the site is in attainment for PM_{10}. Using the EPA ratio of the mass of $PM_{2.5}/PM_{10}$ of 0.58 to calculate the $PM_{2.5}$ fraction, the PM data collected at the site indicate that the area would likely be in attainment for $PM_{2.5}$ [utilizing the 0.58 ratio, the annual $PM_{2.5}$ mean would be 12.6 $\mu g/m^3$ (0.58 x 21.7) and the 24-hour maximum would be 42 $\mu g/m^3$ (0.58 x 73)].

3.2.3 Existing Emission Sources

Existing Sources

Emissions from sources considered to have potential impact on the project area were included in the assessment of air quality impacts. The sources included in the analysis are shown in Table 3.2.3-1.

Table 3.2.3-1 Existing Sources Included in Air Quality Analysis

Source	Location
Babcock & Wilcox Company	West Point, Clay County
Georgia-Pacific Corporation	Duck Hill, Grenada County
Newsprint South, Inc.	Grenada, Grenada County
Holnam, Inc.	Artesia, Lowndes County
Weyerhaeuser Company	Columbus, Lowndes County
Georgia-Pacific Corporation	Louisville, Winston County

3.2.4 Understanding Global Climate Change

The earth's climate is controlled by the radiative balance of the atmosphere. This refers to the radiant energy received from the sun and emitted by the earth back to space. Greenhouse gases (GHGs) include water vapor, CO_2, CH_4, N_2O, and CFCs. With the exception of CFCs, these gases occur naturally. However, human-produced emissions have contributed to the increase in their concentrations. These gases absorb infrared radiation as they pass through the atmosphere and re-emit this energy. This results in a warming of the earth's surface. The greenhouse effect is a natural phenomenon that makes the earth fit for habitation. The earth would be cooler by approximately 30°C without the effect of naturally occurring gases. Most greenhouse gases have a substantial source of natural emissions and for CO_2, natural sources are estimated to be over 20-fold in magnitude of man-made sources (Table 3.2.4-1). A recent estimate of the contribution by different human-produced CO_2 emissions indicates that energy use and production are the largest contributors to GHGs. Carbon dioxide emissions from the production of electrical energy end-use sectors, including industrial, residential and commercial, accounted for approximately 52% of the total manmade in 1996. The bulk of the remaining of the CO_2 emissions are from the direct consumption of fossil fuel energy, including transportation. (DOE/EIA 0573 (1996) Emissions of Greenhouse Gases in the United States, 1996, Energy Information Administration, Office of Integrated Analysis and Forecasting, US DOE, Washington DC, October 1997). In 1990, CO_2 emissions from fossil fuel consumption were estimated at 6,000 (+/- 500) million metric tons of carbon.

Table 3.2.4-1 Global Natural and Anthropogenic Sources and Absorption of Greenhouse Gas

	Sources			
Gas	Natural	Man-Made	Absorption	Annual Increase in Gases in the Atmosphere
Carbon Dioxide (Million Metric Tons of Carbon)	150,000	7,100	154,000	3,100-3,500
Methane (Million Metric Tons of Gas)	110-210	300-450	460-660	35-40
Nitrous Oxide (Million Metric tons of Gas)	6-12	4-8	10-17	3-5
Source: Summarized from ranges appearing in Intergovernmental Panel on Climate Change, Climate Control of Climate Change (Cambridge, UK: Cambridge University Press, 1996), pp. 17 - 19.				

In terms of perturbations to the global CO_2 budget, fossil fuel combustion is almost 3.5 times the magnitude of tropical deforestation (Schimel 1995). Total energy consumption worldwide has increased at a rate of about 2% per year during the past two centuries. This can also be viewed as a doubling of energy consumption every three decades. The rise in energy consumption is intimately tied with economic development and the attendant changes in technology that have allowed greater conversion efficiencies of primary energy forms. With continued population growth and the growth in energy consumption in developing nations, reducing total worldwide CO_2 emissions will be extremely difficult. It is estimated that by the year 2015, if there is no change in global energy policy, emissions from China will equal or surpass the United States.

To help address climate change concerns, TVA is participating in the Administration's Climate Challenge Program. This is a voluntary program between the electric utility industry and the Department of Energy to control greenhouse gas emissions to Year 2000. TVA made the largest commitment of all participants to reduce the growth in greenhouse gas emissions, a 24 million ton CO_2 equivalent reduction by Year 2000. TVA is currently achieving this commitment.

On December 11, 1997, the Third Conference to the Framework Convention on Climate Change completed its work on an international treaty or protocol. This contemplates that the United States would reduce its greenhouse gas emissions by 7% below levels in 1990 by Year 2008 to 2012. The treaty also anticipates or allows emissions trading among participating Nations. Fifty-five Nations must adopt or ratify the treaty before it becomes effective among the nations that ratify it. The treaty opens for ratification in March 1998 and closes March 1999. The treaty currently does not require the participation of developing nations, and the Administration has indicated that it will not submit the treaty to the United States Senate for ratification until it obtains the meaningful participation of developing nations.

3.2.5 New Regulations

Revisions to the ozone and particulate matter NAAQS were promulgated on July 18, 1997, and became effective on September 16, 1997. These revised standards are listed in Table 3.2.2-1. Even though the level and form of the revised ozone and particulate matter standards are known, the implementation schedules pertaining to these standards remain uncertain and are the subject of debate. Currently, EPA contemplates the following:

- Ozone - Following the promulgation date of the revised ozone standard on July 18, 1997, States will have three years (until July 2000) to determine attainment status of all counties and an additional three years (until July 2003) to submit State Implementation Plans (SIPs) for nonattainment areas. The Clean Air Act allows up to ten years plus two 1-year extensions from the date of nonattainment status designation for areas to attain the revised NAAQS.
- Particulate Matter - Following the promulgation date of the revised particulate matter standard on July 18, 1997, States must establish monitoring plans by July 1998, initiate monitoring by September 1998, and have all monitors in place by September 2000. Although this schedule could allow determination of attainment status for some areas as early as September 2001, EPA has announced that it will wait until after its next five-year review of the particulate matter standard (in July 2002) before designating attainment status or implementing any new control requirements. States will be required to submit SIPs in a 2005 to 2008 time frame. Again, the Clean Air Act allows up to ten years plus two 1-year extensions from the date of nonattainment status designation for areas to attain the revised NAAQS.

3.3 Geology

3.3.1 Physiographic Setting

The project area is located in the North Central Hills physiographic province (Vestal and McCutcheon 1943). The terrain is characterized by relatively steep, extensively eroded hills with a maximum local relief of about 280 ft. Streams thoroughly dissect the upland areas forming dendritic drainage patterns. The larger streams, such as Middle Bywy Creek and Besa Chitto Creek, have developed relatively wide low-gradient floodplains in contrast to the steep surrounding upland areas.

3.3.2 Stratigraphy

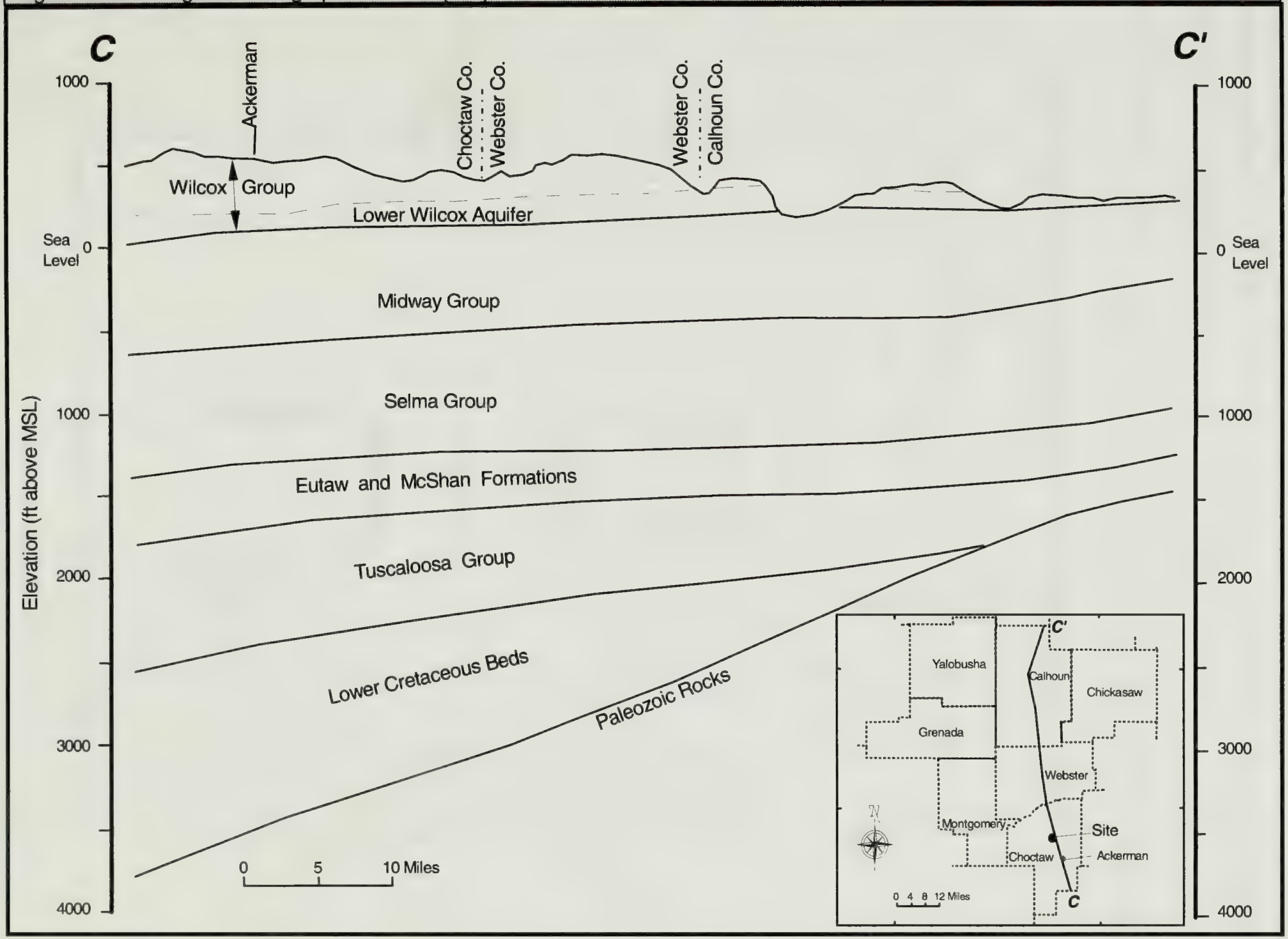
The site lies on the eastern flank of the Mississippi embayment (Cushing et al. 1964). The Mississippi embayment is a southward plunging geosyncline comprised of a thick sequence of marine, deltaic, and fluvial sediments which range in age from Cretaceous to Quaternary. These sediments generally consist of gravel, sand, silt, clay, lignite, marl, chalk, and limestone. The major regional stratigraphic units associated with these sediments are given in Table 3.3.2-1 and are shown in the generalized north-south trending section on Figure 3.3.2-1. Sedimentary units generally dip and thicken to the south and toward the axis of the embayment. The Cretaceous deposits in the northern portion of the embayment, including the site area, overlie older Paleozoic rocks consisting of limestone, shale, chert, and sandstone.

Table 3.3.2-1 Regional Stratigraphic Units

Era	System	Series	Group	Stratigraphic Unit	Thickness (ft)	Water Bearing Characteristics
Cenozoic	Quaternary	Holocene		Flood Plain Deposits	0-50	Small supplies available from shallow wells.
	Tertiary	Eocene	Claiborne	Tallahatta Formation (Meridian Sand Member)	50-225	The principal source of water supply in western part of seven-county study area. Large yields available. Water levels shallow. Water contains iron, but good otherwise.
		Paleocene	Wilcox	Tuscahoma Fm.	400-850	
				Nanafalia Fm., Grampian Hills Member		Minor aquifers in Wilcox are locally important sources of water in Choctaw and Grenada Counties and potentially major sources in Yalobusha County.
				Nanafalia Fm., Gravel Creek Member		100-250 feet thick. Principal aquifer in southeastern part of study area. Iron is a problem.
			Midway	Naheola Formation Porters Creek Clay Clayton Formation	450-900	Not aquifers.
Mesozoic	Cretaceous	Upper Cretaceous	Selma	Prairie Bluff Chalk Ripley Formation Demopolis Chalk Mooreville Chalk	300-900	Ripley supplies many domestic wells in Chickasaw County but few major ones. Limited potential for industrial supplies.
				Eutaw Formation McShan Formation	300-350	Principal aquifer in Clay and Chickasaw Counties, important in Calhoun County. Some iron problems. Fluoride excessive.
			Tuscaloosa	Gordo Formation	200-500	A principal aquifer in Calhoun, Oktibbeha, and Webster Counties. Dissolved solids exceed 400 mg/L. Iron is a problem locally.
				Coker Formation	0-400	Tapped by few wells. Potential source of water supplies in northeastern part of study area. Quality similar to Gordo.
				Massive Sand	0-500	Source of water for a few wells in Lowndes, Lauderdale, and Noxubee Counties.
		Lower Cretaceous		Undifferentiated	0-1100	No wells. Water probably is slightly saline.
Paleozoic				Undifferentiated		Not known to contain aquifers in project area.

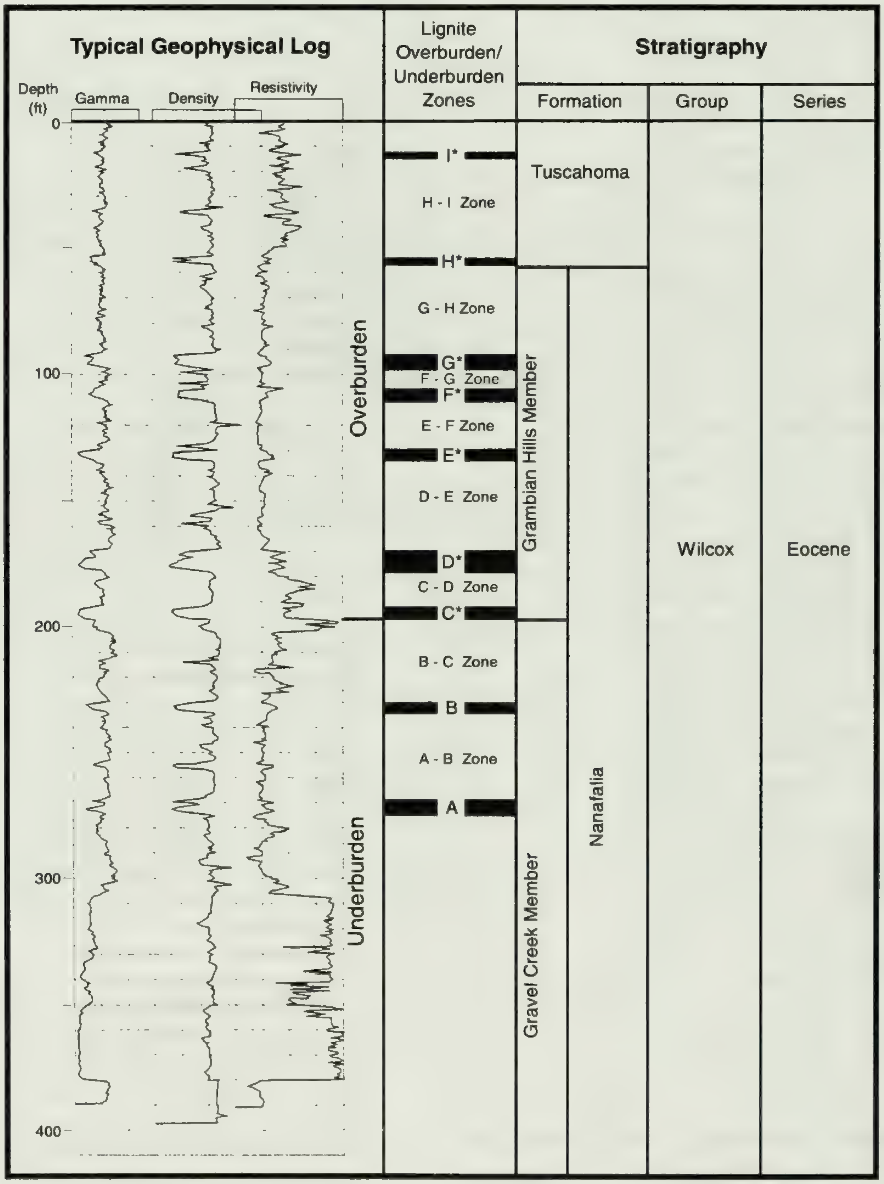
Adapted from Newcome and Bettandorff (1973)

Figure 3.3.2-1 Regional stratigraphic section (adapted from Newcome and Bettandorff 1973).



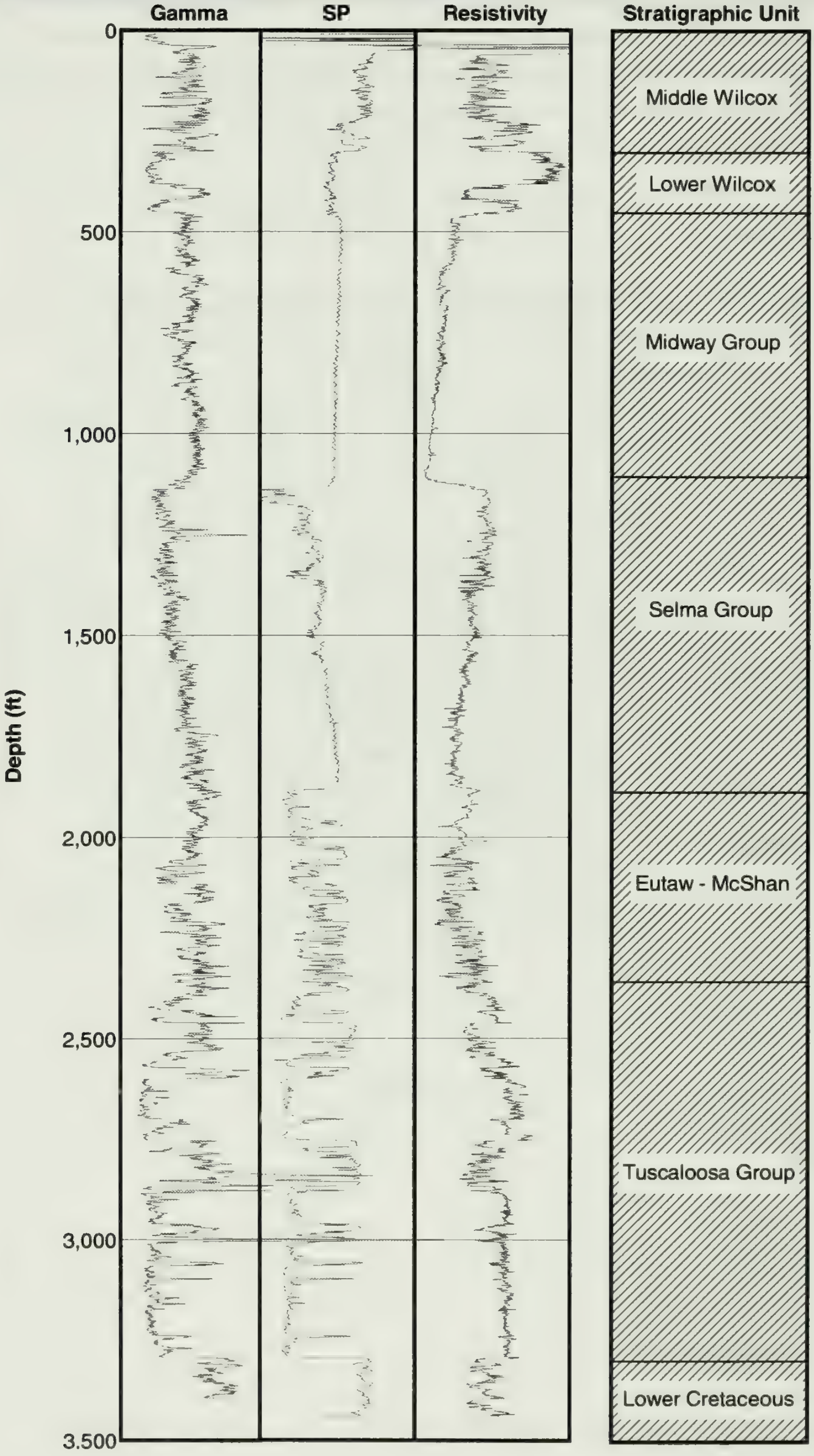
Local stratigraphic conditions in the RHPP area have been established from the extensive shallow exploratory drilling of the lignite reserves (over 600 exploratory holes) and deep drilling to investigate the proposed generation facility make-up water supply. The site lies entirely within the outcrop of the Wilcox Group. The Wilcox averages approximately 400 ft thick in the project area and consists of a heterogeneous, lenticular sequence of clay, silt, sand, and lignite deposits. The geophysical and stratigraphic data presented in Figure 3.3.2-2 show that the lignite seams affected by proposed mining lie within the middle portion of the Wilcox, principally in the Tuscahoma Formation and the Grampian Hills Member of the Nanafalia Formation. Shallow Holocene alluvial deposits derived from erosion of the Wilcox sediments are present beneath the floodplains of the larger streams in the project area.

Figure 3.3.2-2 Shallow stratigraphy of the project area (adapted from MLMC 1997).



Deeper stratigraphy of the site locality is indicated by the geophysical log for Test Hole 1 drilled to evaluate deep aquifers (Figure 3.3.2-3). This test hole extended to a depth of 3,514 ft and fully penetrated (in descending order) the Wilcox, Midway, Selma, Eutaw-McShan, and Tuscaloosa Groups. It terminated in the Lower Cretaceous sediments within about 500 ft of the Paleozoic basement formation. Based on interpretation of the drill logs for Test Hole 1 and neighboring oil and gas wells, the sediments in the site region dip to the southwest at approximately 45 ft/mile.

Figure 3.3.2-3 Geophysical log for test hole 1 with stratigraphic interpretations (adapted from R.W. Harden and Associates 1997).



3.3.3 *Overburden Geochemistry*

Selected geochemical characteristics of the overburden material above the lowest mineable lignite seam (i.e., the "C" seam) are summarized in Table 3.3.3-1. These data are based on the results of chemical analysis of 330 overburden samples collected from 12 continuous coreholes located within the proposed mine area. Coreholes ranged from 113 to 262 ft in total depth. The overburden is generally non-acidic with pH ranging from 3.2 to 8.5 and averaging 6.8. None of the oxidized overburden samples contain acid-forming pyritic sulfur (MLMC 1997). While unoxidized samples frequently contain detectable pyritic sulfur, only 5% of the samples show problematic concentrations greater than 0.5% by weight. Excess acid neutralization capacity is generally indicated with only 6% of the overburden samples exhibiting acid-base accounting levels of less than -5t/1000t. Heavy metal concentrations in the overburden samples are all below upper limits recommended by EPA for land application of sewage sludge (MLMC 1997). The geochemistry of the overburden is discussed further in Section 3.4, Soils.

Table 3.3.3-1 Overburden Geochemical Data Summary + compilation of 330 samples.

Parameter	Units	Mean	Minimum	Maximum	
pH	s.u.	6.8	3.2	8.5	
Potential Acidity	t/1000t	3.5	-0.9	58.1	
Neutralization Potential	t/1000t	12.5	0	80.7	
Acid-Base Accounting	t/1000t	8.6	-56.4	80.7	
Pyritic Sulfur	% by wt.	0.1	0	1.9	
Sodium Adsorption Ratio		1.2	0.2	15.6	
Electrical Conductivity	µmhos/cm	0.7	0	4.9	
Cation Exchange Capacity	meq/100g	22.5	2.6	54.1	
Antimony (total)	ppm	0.6	0	2	
Arsenic (total)	ppm	4.8	0	16	OK
Beryllium (total)	ppm	1.6	0.4	4.6	OK
Boron (soluble)	ppm	0.5	0	4.7	
Cadmium (total)	ppm	0.2	0	4.9	OK
Chromium (total)	ppm	60	13	186	OK
Cobalt (total)	ppm	18	4	57	
Copper (total)	ppm	21	2	65	OK
Iron (exch.)	ppm	6	1	38	
Lead (total)	ppm	14	6	47	OK
Manganese (total)	ppm	399	28	3658	
Mercury (total)	ppm	0	0	0.4	OK
Molybdenum (total)	ppm	2.2	0	9	
Nickel (total)	ppm	28	3	115	OK
Selenium (total)	ppm	1	0	6.6	OK
Zinc (total)	ppm	84	15	269	OK

3.3.4 Mineral Resources

Lignite is potentially available across much of the outcrop area of the Wilcox Group in north-central Mississippi, with Choctaw County containing more lignite than any other county in the state (Vestal and McCutcheon 1943, Gandl 1982). Historically, only limited lignite mining occurred in the region. Vestal and McCutcheon (1943) reported two lignite mining operations in Choctaw County, one near Reform and the other at Blantons Gap; both operations have been abandoned.

Iron ore is reportedly available within portions of Choctaw County and areas to the north (Gandl 1982). Ore is generally found in the form of thin discontinuous lenses and layers of limonite and siderite associated with the Tuscahoma Formation (Holly Springs), the Gravel Creek (Ackerman) member of the Nanafalia Formation, and the Porters Creek Formation. Iron mining is considered impractical in Choctaw County due to extensive overburden and the discontinuous nature of the ore deposits (Vestal and McCutcheon 1943).

Most oil and gas production in Mississippi occurs in the southern part of the state with only very limited production in the northern region (Gandl 1982). Only three hydrocarbon test wells have been drilled in Choctaw County, and none are currently producing (Mississippi Oil and Gas Board, personal communication, 1997). Any future oil and gas development in the region would likely occur in Paleozoic or lower Mesozoic sediments several hundred feet below the Wilcox Group.

Most of the clay deposits within the Wilcox outcrop in Choctaw County are too impure to be of economic value. However, some pure clays of workable thickness and extent have been identified, including a few sites within or near the project area (Vestal and McCutcheon 1943). The Tuscahoma Formation is an abundant source of sand in Choctaw County, including the project area. Sand pits are common throughout Choctaw County with most sand used for construction purposes. Economically-significant sand deposits likely occur in the project area, particularly in areas where the H lignite seam is relatively deep; however, the value of these deposits is unknown.

3.3.5 Seismology

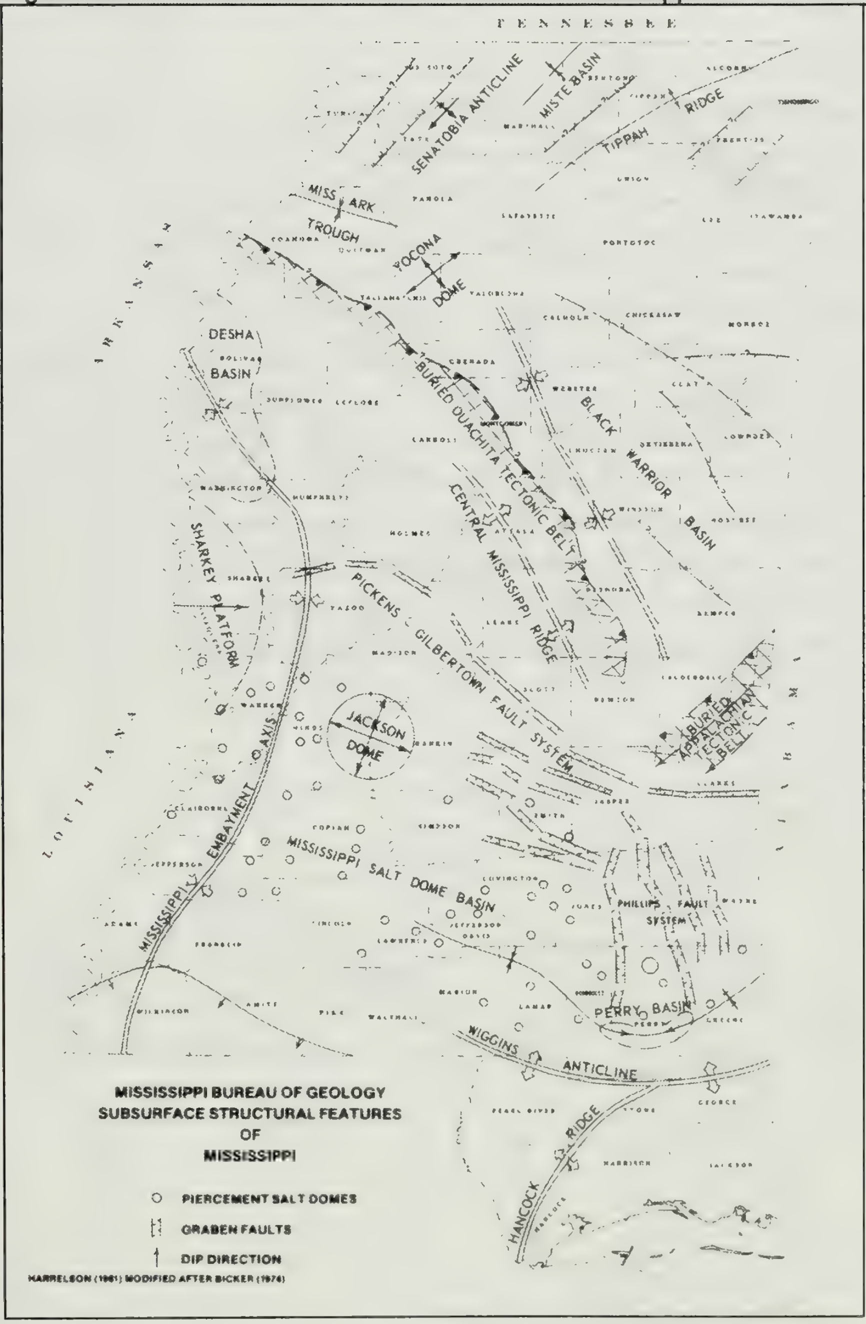
Tectonic Setting

The RHPP site is located within the North American crustal plate, far removed from any tectonic activity occurring at boundaries of the Earth's crustal plates. Most of eastern North America is characterized by a maximum compressive stress that lies near horizontal and is oriented generally east-northeast to west-southwest (Zoback and Zoback 1991). The westward push of the North American plate by the mid-Atlantic ridge creates this compressive stress regime. This type of stress regime results in strike-slip and thrust faulting on fault planes which are favorably oriented to the direction of the maximum compressive stress.

Regional Geologic Structure and Faulting

The RHPP site is located along the northeastern edge of the Gulf Coast Basin. The regional, gulfward dip of sediments has been modified by formation of the north-south trending Mississippi Embayment resulting in a westward component to the dip at the RHPP site (LETCo 1981). The RHPP site is located in the Black Warrior Basin. The Black Warrior Basin formed during the Paleozoic and is a triangular-shaped area bounded on the southeast by the Appalachian tectonic belt and on the southwest by the buried Ouachita tectonic belt (Figure 3.3.5-1).

Figure 3.3.5-1 Subsurface structural features of Mississippi.



No major geologic faulting has been found near the RHPP site (LETCo 1981). Major faulting is defined here to be continuous faulting that can be identified over a distance of several tens of kilometers with fault displacements of 10 meters or more. However, minor faulting involving sediments from the lower portions of the Wilcox series has been inferred from rock exposures south and southeast of Reform, Mississippi (Vestal and McCutcheon 1943). These faults are located from one to four miles east of the RHPP site. These Eocene-age faults trend northwest-southeast and the northeastern blocks have dropped down relative to the southwestern block. Johnson et al. (1994) describe possible rift structures in Mississippi and Alabama that are not shown in Figure 3.3.5-1, which may serve as earthquake source areas (see Appendix C-3).

Earthquake History

Figure 3.3.5-2 shows the locations of earthquakes having a magnitude (body wave magnitude, m_b) of 3.0 or greater in a broad area around the RHPP site during the past 35 years (Council of the National Seismic System - US earthquakes from 1962 to 1997). These earthquakes were concentrated in the New Madrid Seismic Zone, the Southern Appalachians, and the Wabash Valley of Illinois and Indiana.

Since 1886, at least 38 earthquakes (Tennessee Valley Authority 1989; Council of the National Seismic System 1997; Center for Earthquake Research 1997; Stover, Reagor, and Algermissen 1984; Bograd 1992; Steigert 1984; Seeber and Armbruster 1991) have occurred within the area outlined in Figure 3.3.5-3 and Table 3.3.5-1. The location and size of many of these earthquakes are based on accounts of these earthquakes' effects rather than on instrumental data. The locations and magnitudes determined for pre-instrumental earthquakes are much less accurate than for those earthquakes which have been instrumentally recorded. Historically, very few seismographs have been operated in Mississippi and Alabama, and most of the limited instrumental data has been acquired since 1974. It is obvious from Figure 3.3.5-3 that the immediate area around the RHPP site has experienced very few earthquakes in historical time.

Figure 3.3.5-2 Regional seismicity.

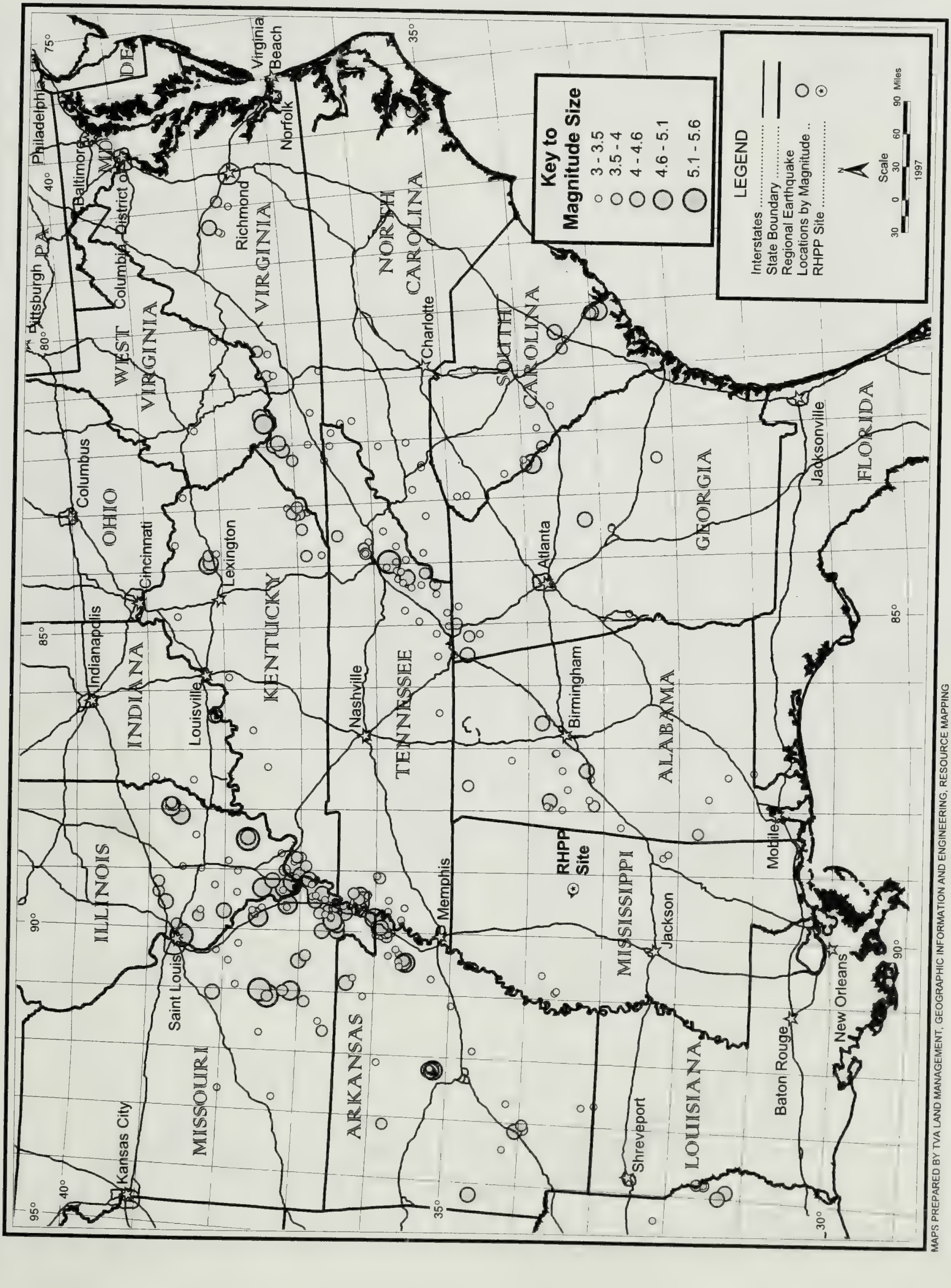
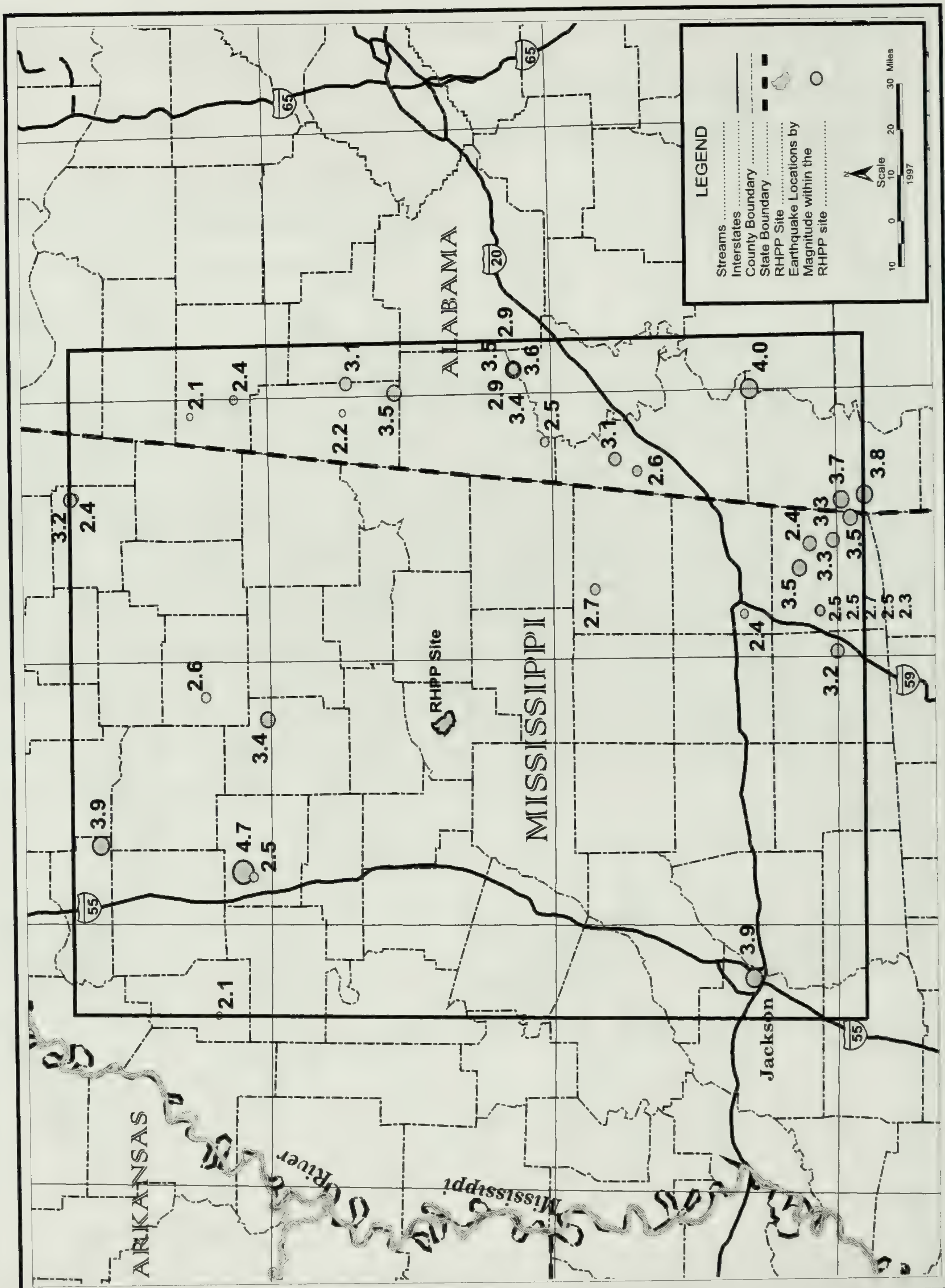


Figure 3.3.5-3 Local seismicity.



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

Table 3.3.5-1 Historical Earthquakes Near the RHPP Site					
Date	Time (Hr:Min:Sec)	Latitude	Longitude	Magnitude	Depth
	Greenwich Mean Time	(Deg, N)	(Deg, W)	(m_b)	(Kilometers)
02/13/1886	12:30:00	32.3	88	4.0	< 5
3/27/1923	8:00:00	34.6	89.7	3.9	9.2
11/13/1927	16:21:00	32.3	90.2	3.9	9
12/17/1931	3:36:00	34.1	89.8	4.7	12.3
9/27/1956	14:15:00	31.9	88.4	3.8	5
10/24/1967	14:34:52	32.7	-88.3	2.6	No Estimate
3/14/1971	17:27:51	33.13	87.91	3.6	No Estimate
3/14/1971	18:43:38	33.13	87.91	2.9	No Estimate
3/15/1971	14:53:22	33.13	87.91	3.4	No Estimate
3/16/1971	2:37:28	33.13	87.91	3.5	No Estimate
3/17/1971	5:04:29	33.13	87.91	2.9	No Estimate
3/1/1975	11:50:00	33.55	87.99	3.5	No Estimate
10/23/1976	0:40:59	32	88.981	3.2	5
5/4/1977	2:00:23	31.982	-88.417	3.7	5
11/4/1977	11:21:07	34.01	-89.22	3.4	2
1/8/1978	11:34:22	32.776	-88.254	3.1	5
6/9/1978	23:15:19	32.094	-88.58	3.3	10
12/11/1978	2:06:48	31.95	-88.484	3.5	5
10/12/1980	11:34:16	34.227	89.135	2.6	10.6
2/15/1981	9:45:40	32.141	88.668	2.4	5
8/26/1981	4:05:33	34.117	88.004	2.4	7
1/29/1983	16:05:32	34.68	88.368	2.4	5
2/5/1983	13:08:19	34.694	88.373	3.2	1.4
5/30/1983	7:14:05	32.329	88.839	2.4	0.4
9/25/1984	1:53:27	34.064	-89.818	2.5	6
8/1/1988	0:32:26	34.187	90.35	2.1	15.2
10/12/1988	12:53:41	32.852	88.741	2.7	No Estimate
8/23/1989		32.061	88.83	2.5	No Estimate
8/23/1989		32.061	88.83	2.5	No Estimate
8/25/1989	14:46:03	32.061	88.83	2.7	6.9
11/26/1989	21:31:00	32.061	88.83	2.3	No Estimate
11/27/1989	1:44:00	32.061	88.83	2.5	No Estimate
5/11/1990	3:42:02	34.272	-88.064	2.1	15.3
6/23/1990	20:44:02	33.72	87.95	3.1	6.4
6/30/1990	16:38:33	33.734	-88.063	2.2	2
7/16/1993	10:54:36	32.013	88.568	3.3	0
6/26/1994	5:50:37	33.025	-88.185	2.5	8.7
3/25/1996	14:15:51	32.131	-88.671	3.5	5

Some of the more significant earthquakes in Table 3.3.5-1 are highlighted in Appendix C-4.

Seismic Source Zones

Since, historically, there have been very few earthquakes near the RHPP site, and because no geologically recent faulting is known near the site, earthquake sources at regional distances comprise significant components of the earthquake hazard to the RHPP site. The five most important seismic zones are the:

- New Madrid Seismic Zone,
- Ouachita—Appalachian Tectonic Belt Junction and Pickens—Gilbertown Fault Zone,
- Southern Appalachian Seismic Zone,
- Wabash Valley Seismic Zone, and
- Charleston, South Carolina, Seismic Zone.

A description of each of these zones is found in Appendix C-5.

Soil Amplification of Ground Motions and Ground Deformation Potential

The strength and thickness of soils strongly influence the amount and type of shaking a structure is subjected to during earthquakes. Generally, sites founded on soft rocks and soils experience much stronger shaking than sites founded on competent, hard rock. The RHPP site is underlain by approximately 4,000 ft of soft rocks and sediments of Cretaceous and Cenozoic age that lie on top of very hard rocks of Paleozoic age. Rocks from the Wilcox series outcrop at the RHPP site (LETCo 1981). Borehole and laboratory testing of the uppermost 100 ft of these soft rocks show that they have Standard Penetration Test (SPT) blow count values averaging around 50 and undrained shear strengths ranging from 500 to 5,000 psf. Based on this information, the soil classification at the site is borderline between category C and D, as defined in the draft 1997 National Earthquake Hazard Reduction Program (NEHRP) Recommended Provisions for Seismic Regulations of New Buildings (Building Seismic Safety Council 1997). The draft 1997 NEHRP Provisions specify amplification factors to apply to ground motions to account for six categories of soil/rock properties ranging from category A (hardest) to F (softest). The amplification factors for categories C and D are given in Appendix C-6.

Earthquake-induced liquefaction occurs most commonly in areas underlain by relatively cohesionless, fine-grained, water-saturated sand layers or lenses that are subjected to strong shaking. Most of the water-saturated sands at the RHPP site occur at depths of 20 ft or more below the ground surface (MLMC 1997), and the deeper sand layers tend to be more consolidated. Thus, there appears to be little opportunity for liquefaction at this site.

Even if some of the soils at the site are liquefiable, it is very unlikely that the generation facility would experience ground shaking strong enough to induce liquefaction within its lifetime. The mining spoil areas would possess the greatest potential for liquefaction, but this is also unlikely because shaking strong enough to induce liquefaction at the site is improbable.

No ground deformation caused by surface faulting is expected at RHPP because no geologically recent faults have been observed at or near the site and because, historically, no earthquakes have been located at or very near the site.

Earthquake Recurrence Estimates and Seismic Hazard

An estimate of the recurrence rate for earthquakes near the RHPP site can be obtained by using Richter's (1958) formula

$$\mathrm{Log}(N_c) = a+b(m_b)$$

where:

> Nc is the cumulative number of earthquakes per year having a size of m_b or larger (m_b is body wave magnitude),
>
> a is the seismic activity parameter, and
>
> b describes the relative rate of large to small earthquakes.

Due to uncertainty in the completeness of the earthquake catalog shown in Table 3.3.5-2, recurrence estimates were taken from two time ranges, each with its own magnitude range. These data subsets and the a and b values derived from them are summarized below:

Table 3.3.5-2 Estimate of Earthquake Recurrence Rate Near the RHPP Site

Range	Time Span	Magnitude Span	a	b
1	1923-1997	3.6 - 4.7	1.46	-0.75
2	1981-1997	2.4 - 3.5	1.97	-0.88

Table 3.3.5-3 displays the results of the U.S. Geological Survey's (USGS) 1996 probabilistic seismic hazard computations for Ackerman, Mississippi. The expected ground shaking is expressed in %g (percentage of the earth's acceleration—981 cm/sec^2) for three different risk factors: 10%, 5%, and 2% chance of exceedance in 50 years for site conditions corresponding to the NEHRP B-C boundary. For design purposes, these ground shaking levels should be modified to account for the presence of soil category C or D at the site (see Appendix C-6). These ground shaking levels are quite low relative to other areas in the eastern United States, and are much lower than the ground shaking expected in most of the western United States.

Table 3.3.5-3 Seismic Hazard for Ackerman, Mississippi, Based on the USGS 1996 Seismic Hazard Maps

Zip Code	39735		
Location	33.3096 Lat.	-89.1730 Long	
Probabilistic Ground Motion Values, In %g (NEHRP B-C Boundary)			
	10% PE* in 50 yr	5% PE in 50 yr	2% PE in 50 yr
Peak Ground Accel.	3.04	5.14	9.71
0.2 sec Spectral Ampl.	7.68	12.66	24.42
0.3 sec Spectral Ampl.	6.83	11.70	22.16
1.0 sec Spectral Ampl.	3.37	6.07	12.22

*Probability of Exceedence

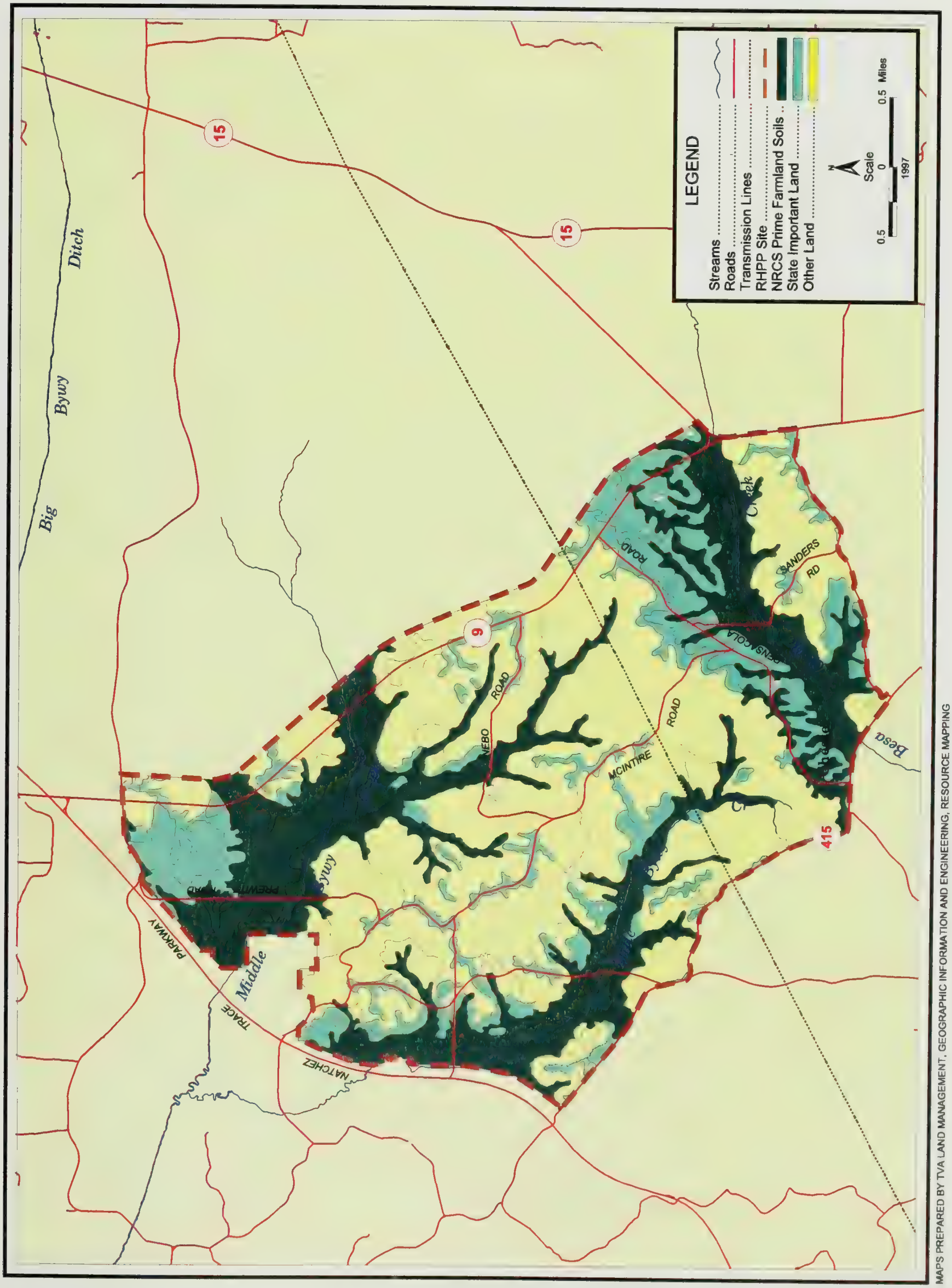
3.4 Soils

The soils in Choctaw County and the RHPP site occur within the Upper Coastal Plain physiographic region (Vanderford 1975). In Mississippi, this area occupies about 7.5 million acres. Soils on the uplands range from gently sloping to very steep, and are formed from unconsolidated marine sediments (sands, silts, clays, and some gravel) and thin loess (wind-blown silt) deposits. The bottomland soils of local streams are nearly level and are derived from alluvial sediments that were eroded from nearby uplands. This section discusses the classification and description, productivity, use capability, and prime farmland status of the soils of the 9,300-acre study area and proposed new 161-kV transmission line and natural gas pipeline corridors.

3.4.1 Soil Classification and Description

The description, laboratory analysis, and use suitabilities of the soils of the project site are presented in greater detail in the published soil survey of Choctaw Country (USDA-SCS 1986), Mississippi Agricultural and Forestry Experiment Station publications (Vanderford 1975; Pettry and Switzer 1993), and the proposed RHPP mining permit application (MLMC 1997). The Order 2 (detailed) Natural Resources Conservation Service (NRCS, formerly SCS) soil survey identifies 15 soil series and 22 mapping units within the project area. Table 3.4.1-1 lists these mapping units and soil associations, their corresponding map symbol, and the extent of each area in acres and percentage of the total project area. The geographic locations of these soil units are arranged by three land categories (Prime Farmland Soils, State Important Land, Other Land) and are illustrated in the map shown in Figure 3.4.1-1.

Figure 3.4.1-1 Soils.



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

Upland soils occur on approximately 72% of the project area. Typically these are moderately-well to well-drained soils on rolling to very steep ridges and hillsides. The dominant upland soils are in the Smithdale, Sweatman, Providence, and Ora series (Table 3.4.1-1). Soils on the uplands are highly weathered, and are generally medium to strongly acid throughout the pedogenic soil profile. Many have a thin surface A horizon because of past erosion. Surface soil textures are generally fine sandy loam, silt loam, or loam, while subsoil textures are commonly sandy or silty clay loams, sandy or silty clays, or clay. A firm, brittle, compact fragipan horizon occurs at a depth of about 20 to 60 inches in some of the soils. Most of the upland soils are in deciduous, pine, or mixed forest uses, with some of the less sloping areas being used for pasture and hay.

Bottomland soils of local streams occur on about 28% of the project area. These are nearly level, poorly- to well-drained soils developed from alluvial sediments. The bottomlands are occupied primarily by the Oaklimeter and Chenneby soil series (Table 3.4.1-1). Most of these soils lack well-defined horizon development, and are moderately to strongly acidic throughout their profile. Surface textures are generally silt loam, but some are fine sandy loam or loam. Subsoil textures are generally silt loam, silty clay loam, or loam. The majority of the bottomland soils are subject to occasional flooding and some are subject to frequent flooding, and therefore, are mostly in pasture, hay, and forest uses. A small acreage is used for row-crops such as corn and truck crops. Most of the prime farmland soils occur in the bottomland and terrace landscape positions along the local streams (Figure 3.4.1-1). Prime farmland soils will be discussed in greater detail in Section 3.4.3.

Table 3.4.1-1 Soils in the RHPP Study Area

Map Unit and Description	Map Symbol	Acres	%
Ariel silt loam, 0-2% slope, well-drained, occasionally flooded [a)]	Ae	135	1.5
Arkabutla silt loam, 0-2% slope, somewhat poorly drained, occasionally flooded [a)]	Ak	43	0.5
Bude silt loam, 0-2% slope, somewhat poorly drained [a)]	Bu	115	1.2
Cascilla silt loam, 0-2% slope, well-drained, occasionally flooded [a)]	Ca	179	1.9
Chenneby silt loam, 0-2% slope, somewhat poorly drained, occasionally flooded [a)]	Ce	688	7.4
*Guyton silt loam, 0-2% slope, poorly drained, occasionally flooded [b)]	Gu	57	0.6
Maben silt loam, 5-8% slope, well-drained, shaly clay subsoil [b)]	MaC	28	0.3
Oaklimeter silt loam, 0-2% slope, moderately well-drained, occasionally flooded [a)]	Oa	1,366	14.8
Ora loam, 5-8% slope, moderately well-drained, eroded [b)]	OrC2	98	1.1
Ora loam, 8-12% slope, moderately well-drained, eroded [b)]	OrD2	555	6.0
Pits-Udorthents complex, disturbed land	Pf	14	0.2
Providence silt loam, 2-5% slope, moderately well-drained, eroded [a)]	PoB2	224	2.4
Providence silt loam, 5-8% slope, moderately well-drained, eroded [b)]	PoC2	578	6.2
*Rosebloom silt loam, 0-2% slope, poorly drained, occasionally flooded [b)]	Ro	15	0.2
Smithdale-Ruston association, 5-35% slope	SR	35	0.4
Smithdale-Sweatman association, 12-35% slope	SS	2,195	23.7
Sweatman silt loam, 5-8% slope, well-drained, shaly clay subsoil [b)]	SwC	103	1.1
Sweatman fine sandy loam, 8-15% slope, well-drained, shaly clay subsoil	SwE	451	4.9
Sweatman fine sandy loam, 15-25% slope, well-drained, shaly clay subsoil	SwF	178	1.9
Sweatman-Providence association, 12-35% slope	SX	1,864	20.2
Tippah silt loam, 2-5% slope, moderately well-drained, eroded [a)]	TaB2	15	0.2
Tippah silt loam, 5-8% slope, moderately well-drained, eroded [b)]	TaC2	311	3.4
	Total	9,246	100.0

[a)] Prime farmland soils. (Total = 2,765 acres, 30% of area)
[b)] State important land. (Total = 1,745 acres, 19% of area)
*Hydric soils. (Total = 72 acres, 0.8% of area)
Source: USDA-SCS, 1986. Soil Survey of Choctaw County, Mississippi.

Two hydric soils occur on the stream floodplains and low terraces. A hydric soil is defined as a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Specific criteria, including depth of high water table and flooding frequency and duration, are described for each soil series by the USDA Natural Resources Conservation Service (USDA-SCS 1991). The two hydric soils occurring in the project area are the poorly drained Guyton silt loam and Rosebloom silt loam soil map units. The acreages of these two hydric soils are indicated in Table 3.4.1-1, and their geographic locations are shown on the map in Figure 3.4.1-1. Hydric soils occur on about 0.8% of the project area. More detailed discussion of hydric soils in context of wetlands delineations will be given in Section 3.8.

As background data for determining crop and forest production potentials and use limitations for soils occurring in the project area, a summary of select physical and chemical properties of the corresponding soil series is given in Appendix C-7. These data are derived from the published Choctaw County soil survey (USDA-SCS 1986). Several important soil characteristics which could have important implications for land reclamation and postmining land use should be pointed out from these data.

With few exceptions, soils of the project area are moderately to strongly acid, with a range of surface and subsoil pH of 4.5 to 6.0. Most soils presently have a good mixture of sand, silt, and clay-sized sediments, and moderate bulk densities (1.35 to 1.55 g/cm^3), throughout the surface and subsoil horizons. Three soil series, (Bude, Ora, and Providence) contain a firm, compact fragipan horizon at a depth of about 20 to 60 inches. In a natural state, these dense subsoil horizons result in poor root penetration and low water percolation rates. Fragipan disruption and selected overburden material replacement should benefit the physical characteristics of these three soils.

The natural erodibility of soils in the project area are represented by the K factors shown in Appendix C-7. The higher the number, the more erosive the soil, based on experimentally-measured soil losses from controlled fallow plots of specified slope length and steepness (Wischmeier and Smith 1978). The most important factor influencing the soil K factor is particle size distribution (soil texture), with organic matter content, soil structure, and permeability also important. Several project area soils are quite erodible, with K factors above 0.40. These all have silt loam textures, reflective of the general increasing erodibility with increasing silt fraction. Erosion tolerance (T value) estimates for soils of the project area range from 3 to 5 tons/acre/year (Appendix C-7). Erosion tolerance is defined as the maximum rate of soil erosion which will permit a high level of crop productivity to be sustained economically and indefinitely (Wischmeier and Smith 1978).

A detailed characterization of the major soils was obtained by detailed sampling of ten soil profiles from each of six dominant soil series. These representative soils occupy about 90% of the project area. Fifty-three kinds of chemical and physical soil analyses were determined on these soil samples for use as premining baseline data for mining permit needs. Appendix C-8 illustrates some of these data which have much significance to soil productivity and land reclamation: pH, percent sand and clay, cation exchange capacity (CEC), percent base saturation, and acid-base accounting ($CaCO_3$ equivalent/1000 tons).

It is quite apparent that soil pH and texture in the six soil series analyzed for the native soils database (Chenneby, Oaklimeter, Ora, Providence, Smithdale, Sweatman) are well within the soil characteristics established for these taxonomic soil series (Appendix C-7). Soil pHs range from about 4.6 to 5.1, with small standard deviations (SD), throughout all soil horizons sampled (Appendix C-8). The mean percent base saturation of the total CEC ranges from 22% to 63% among the six soils. The mean acid-base accounting values range from -3.8 to +0.2 tons $CaCO_3$ equivalent/1000 tons of soil (Appendix C-8). Soil horizons with high negative acid-base accounting values have high values of exchangeable acidity, and will require higher rates of liming materials to neutralize this adverse soil fertility condition.

Because the permit application requested use of topsoil substitution (selected oxidized overburden) during reclamation, 12 continuous overburden cores were sampled. The chemical and physical results of these analyses for the proposed 37-year mining (permit) area are shown Appendix C-9 and Appendix C-10. In terms of potential soil productivity, it is apparent that the mean soil pH, percent sand, percent clay, CEC, percent base saturation, and acid-base accounting values of the lower oxidized zone are equal to or somewhat more suitable than these characteristics in the upper oxidized (pedogenic) zone (Appendix C-9).

It is noteworthy that none of the oxidized overburden samples contained acid-forming pyritic sulfur (Appendix C-10). Unoxidized samples frequently contain detectable pyritic sulfur; however, only 5% of the samples show problematic concentrations at over 0.5%. The low values of heavy metals in overburden core samples (Appendix C-10) should not prohibit use of oxidized overburden as topsoil substitution in postmining revegetation. Concentrations of arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc are all below the ceiling concentrations established for land application of sewage sludge (EPA Chapter 40 Code of Federal Regulations, Part 503). In a recent study of metal concentrations in soils and parent materials of Mississippi, Pettry and Switzer (1993) reported that concentrations of cadmium, copper, zinc, lead, and nickel in the Wilcox Group of Choctaw County (Upper Coastal Plain) were low compared with other soil parent materials of Mississippi. A review of overburden core data collected within the permit area also does not indicate the occurrence of detrimentally-high values for sodium adsorption ratio (SAR) or electical conductivity (EC) in the oxidized zones. Among the 12 overburden core samples taken, the total depth of oxidized sediments ranged from about 9 to 72 feet (Appendix C-9 and Appendix C-10).

3.4.2 Soil Capability and Productivity

The NRCS uses a land capability classification to rate soils for determining, in a general way, how suitable they are for most kinds of farming (USDA 1961). This system groups soils according to potentials and limitations for long-term production of cultivated crops, pasture, range, or forest, without soil deterioration through erosion. There are three levels of soil groupings; the capability class, subclass, and unit. The capability classes are designated by roman numerals I through VIII. The risk of soil damage or limitation for use becomes progressively greater from Class I through Class VIII. In general, soils in Classes I through III are suitable for row crops, Class IV soils are suitable for sown crops and possibly some row crops, and soils in Classes V through VIII are limited largely to pasture, woodland, wildlife, and other similar uses.

The capability subclasses indicate major kinds of limitations within the classes. Soils where the main limitation is risk of erosion are designated with the letter *e*. When the primary risk is excess water in the soil or on the surface, a *w* designation is shown. The symbol *s* indicates that the soil is limited mainly because it is droughty, shallow, or stony.

As shown in Appendix C-11, the soils with the highest production potential for corn, cotton, soybeans, wheat, common bermudagrass, and tall fescue in the RHPP area are capability Class IIw bottomland soils

and Classes IIe and IIIe upland soils. These include the following soils series: Ariel, Arkabutla, Bude, Cascilla, Chenneby, Oaklimeter, Ora, Providence, and Tippah. Within the project area, however, these soils do not have a recent history of extensive use for cultivated crops. Excess soil wetness and occasional flooding problems hinder agricultural use of some of the bottomland soils (especially capability Classes IVw Guyton and IIIw Rosebloom series). Upland soils range from capability Class II to VII, but are mostly IV, VI, and VII. The more severe limitations are due to steepness of slope, which increases the susceptibility of these soils to erosion if they are not maintained in a permanent cover. Almost all of these steeper soils in the RHPP area are in forest use.

With about 82% of the project area in forest land use categories (Section 3.12), a summary of the forest suitability and potential productivity (site index) of the native soils in the project area is given in Appendix C-12, for possible use in postmining reforestation. The potential suitability and productivity of the various soils for forest production are determined by two important ratings given in the table: suitability group and site index.

As indicated by Table 3.4.1-1 and Appendix C-12, the soils which have the highest general suitability and site indexes for production of both needleleaf (pines) and broadleaf (hardwood) forest species occur in the bottomlands. Site indexes of 100 or higher are common for several hardwood types. Upland soils are generally more droughty and less fertile and, therefore, have lower potential productivity for most forest types. A variety of hardwood species (including several oaks, yellow poplar, cottonwood, and green ash) have high potential productivity on some soils, particularly in bottomland soils of fair to good internal drainage. Loblolly pine and sweetgum have moderately high site indexes (80 to 90) in much of the upland soils, especially the Tippah, Ora, Providence, and Smithdale series.

3.4.3 Prime Farmland Soils

Prime farmland soils, as defined by USDA-NRCS, are those that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. They have properties needed for the economic production of sustained high yields of crops. Prime farmland soils may presently be in use as cropland, pasture land, range land, forest land, or other uses, but cannot be urban or built-up-land. The conversion of farmland and prime farmland soils to industrial and other nonagricultural uses essentially precludes farming the land in the foreseeable future. Recognizing the serious impacts on food and fiber production from such long-term land use trends, the Federal Farmland Protection Policy Act (FFPPA) was signed into law in 1981 (U.S. Code of Federal Regulations Title 7, paragraph 567). Amendments to FFPPA were subsequently made in 1984 and 1994 (7 CFR Part 658).

Within the project area, NRCS prime farmland soils occur on level to gently sloping land (usually less than 5% slopes). Other farmland of statewide importance, mostly soils on 5 to 12% slopes, are not considered significant for production of agricultural crops within the project area. There are eight soil mapping units classified as prime farmland soils which constitute 30% of the project area. These are identified in Table 3.4.1-1 and Figure 3.4.1-1. Four soil mapping units which represent 89% of the prime farmland soils area are: (1) Oaklimeter silt loam, 0 to 2% slope; (2) Chenneby silt loam, 0 to 2% slope;

(3) Providence silt loam, 2 to 5% slope; and (4) Cascilla silt loam, 0 to 2% slope. About 91% of the prime farmland soil acreage occurs in the stream bottomlands. The prime farmland soils are currently used mostly for pasture/hay and woodland uses, with a minor acreage in row-crop usage. The frequency of flooding in the bottomlands during the growing season probably has some hindrance effect on the intensive use of prime farmland soils for row crops. The "historic" use of prime farmland for cultivated cropland and pasture/hay uses is minimal within the project area.

Following regulations and guidelines established by the Federal Farmland Protection Act (USDA-SCS 1984), a Farmland Conversion Impact Rating (Form AD-1006) was prepared for the soils occurring within the combined generation facility, mining, and EcoPlex areas (Figure 3.4.1-1 and Table 3.4.1-1). Based on the 2,765 acres of prime farmland soils in the project area and county soil resource considerations, a rating of 38 (out of 100) was assigned by the USDA-NRCS staff for the Land Evaluation criteria, and a scoring of 66 was estimated for Site Assessment. A total point score of 104 (38+66) was assigned for potential farmland conversion impact.

3.4.4 Soils and Prime Farmland in Utility Corridors

The soils and prime farmland in two alternative 161-kV transmission line corridors proposed between the RHPP site and Sturgis, Mississippi, were identified and measured from the published soil survey. The proposed Corridor B (see Section 2.2.3), from Sturgis to the abandoned ICG railroad line and west to the RHPP site boundary, traverses primarily forested, rolling to hilly terrain, consisting primarily of soils of the Smithdale, Maben, Providence, Ora, and Sweatman series. There are about 196 acres of prime farmland soils. These are primarily soils in stream bottomlands: Kirkville silt loam, Oaklimeter silt loam, and Mantachie loam. The Corridor A (see Section 2.2.3), or "Preferred Corridor," extending from Sturgis to Ackerman, north along the abandoned ICG railroad and west to the RHPP site boundary, also largely consists of forested, rolling to hilly upland soils (Maben, Providence, Smithdale, Ora, Sweatman soil series). There are, however, about 335 acres of prime farmland soils, occurring largely along the abandoned railroad line north of Ackerman. Within this proposed corridor, the prime farmland soils are level to gently sloping Oaklimeter silt loam, Mantachie loam, Providence silt loam, and Ruston fine sandy loam soils.

The occurrence of hydric (poorly-drained) soils is quite significant in Corridor A (71 acres). No hydric soils occur within Corridor B. This soil has excess soil moisture during most of the growing season, and is classified as land capability Class IVw Guyton silt loam, 0 to 2% slope.

The soils that could be temporarily impacted by construction of a new natural gas pipeline proposed between the EcoPlex site and the existing interstate pipeline north of Ackerman have largely been described in the above paragraphs. The new natural gas pipeline is proposed to be constructed within part of the land corridor described for Corridor A alternative 161-kV transmission line. About 215 acres of prime farmland soils occur within the pipeline corridor, mainly along the abandoned railroad. These soils are classified as Oaklimeter silt loam, 0 to 2% slope; and Providence silt loam, 2 to 5% slope. There are also about 14 acres of hydric soils (Guyton silt loam, 0 to 2% slope). The adjoining upland

soils that occur within this land corridor include rolling to hilly soils of the Sweatman, Providence, Ora, Smithdale, and Tippah series.

3.5 Groundwater Resources

3.5.1 Groundwater Hydrology

3.5.1.1 Regional Setting

The principal aquifers in the site region are (in descending order) the Meridian-Upper Wilcox, the Middle Wilcox, the Lower Wilcox, the Eutaw-McShan, and the Tuscaloosa Aquifer System. The stratigraphic relationship between these aquifers is indicated in Table 3.3.2-1 and Figure 3.3.2-1. The general water-bearing characteristics of these aquifers are summarized in Table 3.5.1-1.

Table 3.5.1-1 Water-Bearing Characteristics of Regional Aquifers

Aquifer	Transmissivity (ft^2/d)			Well Yield (gpm)		
	median	min	max	median	min	max
Meridian-Upper Wilcox	--	150[e]	17,400[e]	--	--	2,800[e]
	2,700[b]	130[b]	20,000[b]	--	50[c]	2,800[c]
Middle Wilcox	--	270[a]	2,800[a]	--	--	350[a]
				--	50[c]	600[c]
Lower Wilcox	5,300[e]	670[e]	51,000[e]	--	--	2,000[e]
	5,000[b]	100[b]	35,000[b]	--	--	--
	--	1,200[a]	6,000[a]	--	40[c]	400[c]
Eutaw-McShan	--	200[e]	4,900[e]	--	--	770[e]
	1,000[b]	20[b]	6,000[b]	--	44[c]	600[c]
Tuscaloosa Aquifer System	3,200[b]	120[b]	80,000[b]	250[d]	25[d]	2,300[d]
				--	100[c]	350[c]
				--	100[c]	300[c]

Sources: [a]MLMC (1997); [b]Slack and Darden (1991); [c]Newcome and Bettandorff (1973); [d]R. W. Harden & Associates (1997); [e]Gandl (1982)

The Meridian-Upper Wilcox Aquifer (MUWA) is composed of the Meridian Sand Member of the Tallahatta Formation and the uppermost sand of the Wilcox Group. These units form a continuous sand bed ranging from 50 to 225 ft thick. The MUWA crops out in a northwest-southeast trending band which lies just west of the project area. Although the MUWA is an important freshwater aquifer in the region, it is of minor importance in Choctaw County as it is present only in the western and southern parts of the county. The greatest development of this aquifer has been in Grenada and Yalobusha Counties with less development in Montgomery, Webster, and Choctaw Counties. The aquifer receives recharge from precipitation in its outcrop area. Groundwater movement from the outcrop is generally westward. The potentiometric surface dips westward at about 5 ft/mile (Newcome and Bettandorff 1973).

The Tuscahoma Formation and Grampian Hills Member of the Nanafalia Formation are commonly referred to as the Middle Wilcox Aquifer (MWA). These formations generally correlate with the portions of the Wilcox proposed to be mined. Within the RHPP area, the MWA typically contains less sand and is of lower production capacity than the Lower Wilcox Aquifer. However, in other parts of Choctaw County and throughout much of Mississippi down-dip of the RHPP area, thicker channel sands of higher productivity are found. Also, low well yields associated with lower values of both transmissivity and hydraulic conductivity are predominant in the MWA in the RHPP area. Water in the Wilcox sands in Choctaw County is normally fresh with less than 500 mg/L total dissolved solids and, other than some elevated iron and manganese levels, generally meets drinking water standards.

The Gravel Creek Member of the Wilcox Group and the Coal Bluff Member of the Midway Group comprise the Lower Wilcox Aquifer (LWA). The LWA is a freshwater aquifer of major importance in the region, particularly in Choctaw County. The aquifer generally consists of lenticular deposits of poorly sorted, fine- to medium-grained sand. From its outcrop in Calhoun, Webster, and Choctaw Counties the LWA dips west-southwest at 30 to 35 ft/mile. The aquifer ranges up to 250 ft in thickness regionally, but sand thickness is extremely variable and may be absent in some areas. The LWA is recharged by precipitation in the outcrop area from which groundwater movement is generally westward. As with most aquifers of the Mississippi Embayment, groundwater quality in the LWA tends to deteriorate down-dip. The western freshwater limit lies about 20 miles west of the project area. In Choctaw County, the larger well yields of fresh groundwater are typically found in the LWA. Since the thickness of the LWA is extremely variable, hydraulic characteristics and well yields from sands also vary widely.

Sands of the Eutaw and McShan Formations constitute the Eutaw-McShan Aquifer (EMA). The aquifer crops out in a north-south trending band located about 40 miles east of the project area. From the outcrop area the aquifer dips westward at approximately 35 to 40 ft/mile. The aquifer thickness increases down-dip, achieving a maximum sand thickness of about 300 ft. The EMA receives recharge from precipitation in its outcrop area and, to a lesser extent, from overlying and underlying aquifers (Strom and Mallory 1995). Water becomes increasingly mineralized down-dip and contains saline water (total dissolved solids content exceeding 500 mg/L) in Choctaw County (Newcome and Bettandorff 1973).

The Tuscaloosa Aquifer System (TAS) consists of the Gordo, Coker, and Massive Sand aquifers of the Tuscaloosa Group, along with deeper undifferentiated Lower Cretaceous sediments (Strom and Mallory 1995). The sand beds comprising these aquifers are separated by interbedded clays and silts, but are generally believed to be hydraulically interconnected. Within the project area, the TAS is present between depths of about 2,300 and 4,000 ft (R.W. Harden & Associates 1997). The TAS outcrops in northeastern Mississippi and western Alabama. The sediments that comprise the TAS dip westward or southwestward toward the axis of the Mississippi Embayment at about 35 to 40 ft/mile and generally tend to become thicker in the down-dip direction. The total combined sand thickness of the TAS in the project area is about 600 ft (R.W. Harden & Associates 1997). Recharge of the Gordo and Coker members of the TAS occurs in their outcrop areas. These units may also receive recharge by leakage from vertically-adjacent aquifers in areas further down-dip. The Massive Sand aquifer is not exposed at

land surface and is assumed to receive recharge from the overlying Coker aquifer in its outcrop region. Similarly, the Lower Cretaceous aquifer does not outcrop and recharge is assumed to occur by leakage from the Massive Sand in up-dip areas (Strom and Mallory 1995). Regionally, the horizontal direction of groundwater movement within the TAS ranges from westerly to southerly away from the outcrop areas. The freshwater limits (i.e., TDS < 500 mg/L) of the TAS are well to the north and east of Choctaw County.

3.5.1.2 Project Area

The groundwater hydrology of the RHPP area has been characterized through measurement of groundwater potentiometric surfaces, aquifer testing, groundwater sampling, and geophysical logging. Hydrogeological studies primarily focused on two separate groundwater regimes: (1) the Wilcox Group in which the proposed lignite mining would occur, and (2) the TAS, the proposed source of water for generation facility operations. Investigation of the Wilcox included installation of a network of 43 test wells. Baseline groundwater quality samples and water level measurements were collected quarterly in selected wells between November 1996 and August 1997. Fifteen aquifer tests were conducted in the more permeable sediments of the Wilcox and upper Midway formations. The hydraulic properties of the less permeable materials associated with these formations were measured through laboratory testing of core samples. In addition, a water well inventory was conducted during early 1997 to determine locations of private water wells and springs in the project area, all of which derive their water from the Wilcox Group. Onsite hydrogeological studies of the TAS were primarily limited to exploratory drilling, geophysical logging, and water sampling of a single test hole. Geophysical logs and water quality data for nearby test wells in the region were also reviewed as part of the TAS investigations.

With the exception of relatively small areas occupied by floodplain alluvial deposits associated with the larger streams, the project area is entirely underlain by sediments of the Wilcox Group. The overall thickness of the Wilcox averages about 400 ft in the project area. The portion of the Wilcox section proposed to be mined (i.e., the overburden) predominately consists of fine-grained deposits of interbedded clay, sandy clay, and silt. Sands present within the overburden interval are commonly thin, sporadic in occurrence, and generally an insignificant groundwater resource. The most persistent sand in the overburden is the CD sand, which exceeds ten feet in thickness in only about one-third of the test wells. Aquifer tests conducted in 13 wells drilled in overburden sediments indicated transmissivities ranging from 0.03 to 244 ft^2/d and averaging 73 ft^2/d. Overburden hydraulic conductivities ranged from 0.003 to 7.7 ft/d and averaged 3.4 ft/d (MLMC 1997).

The most significant freshwater aquifer in the project area is the LWA. Sand beds associated with the LWA typically occur from 50 to over 100 ft below the C lignite seam, the deepest lignite seam proposed to be mined. These underburden sands occur throughout most of the project area. The sands are variable in stratigraphic position within the LWA and their thickness and texture vary considerably. Logs of wells penetrating these sands typically show sand thickness of less than 20 ft to about 150 ft. Aquifer tests conducted in the underburden sands, including those within the LWA, indicated transmissivities ranging from 57 to 2,219 ft^2/d and averaging 770 ft^2/d. Underburden hydraulic conductivities calculated

from the aquifer tests ranged from 4.1 to 31 ft/d and averaged 15 ft/d. Storativities (volume of water released from storage per unit decline in head per unit surface area, dimensionless) in the overburden and underburden are on the order of 1 x 10^{-4} to 5 x 10^{-4}, indicating confined conditions. Specific yield (i.e., storativity as applied to unconfined aquifers), although not measured, is estimated to be in the range of 0.15 to 0.25 (MLMC 1997).

Laboratory hydraulic conductivity tests were performed on core samples taken from selected overburden and underburden materials. Eight tests were conducted on samples taken from the area of proposed mine operations for the first five years. Hydraulic conductivities in the Wilcox clay samples ranged from 1 x 10^{-7} to 9.4 x 10^{-9} cm/s (or 2.8 x 10^{-4} to 2.7 x 10^{-5} ft/d) indicating that these clay units act as confining layers to the Wilcox sand beds. This conclusion is supported by aquifer tests in which pumping from individual sand beds produced little or no hydraulic response in vertically-adjacent sands, and is applicable to the entire proposed mine area (MLMC 1997).

Groundwater occurs under both water-table and confined conditions in the various sediments of the Wilcox Group. Depth to water in Wilcox sand units range from about 240 ft below ground level to a few feet above ground level, depending on land surface elevation, the zone screened, and nearby recharge and ? discharge features. Groundwater in the shallowest Wilcox sediments is under water-table conditions, and movement is largely controlled by topography. As shown on Figure 3.5.1-1, the potentiometric levels in the deepest confined overburden zone (i.e., the CD zone) indicate that groundwater flows in a southwesterly direction, generally coinciding with the dip of the Wilcox Formation. The potentiometric surface of the underburden (principally the LWA) also shows a southwesterly gradient. Data indicate that the potentiometric surface of the CD overburden zone is 17 to 64 ft higher than that of the underburden sands, indicating that the vertical component of the hydraulic gradient in the Wilcox is downward in the project area. Water level fluctuations during the 1996 to 1997 study period were generally less than 2 ft in most Wilcox wells, with a maximum fluctuation about 10 ft in well 3571-UB2 (Figure 3.5.1-1) (MLMC 1997).

? Bustry => Springs probably OK

Groundwater enters the Wilcox sediments by infiltration of precipitation. In general, the factors influencing the amount of recharge in the Wilcox are the amount and distribution of precipitation, topography, permeability of surface materials, type and amount of vegetation, and the ability of the subsurface materials to accept recharge and transmit it to areas of discharge. Recharge of surficial sands either (1) discharges to seeps or springs where sands outcrop along hillsides, (2) percolates into underlying strata, or (3) is lost to evapotranspiration. The spring inventory in the project area identified 90 Wilcox springs having flows ranging up to 30 gpm and averaging 9 gpm (MLMC 1997).

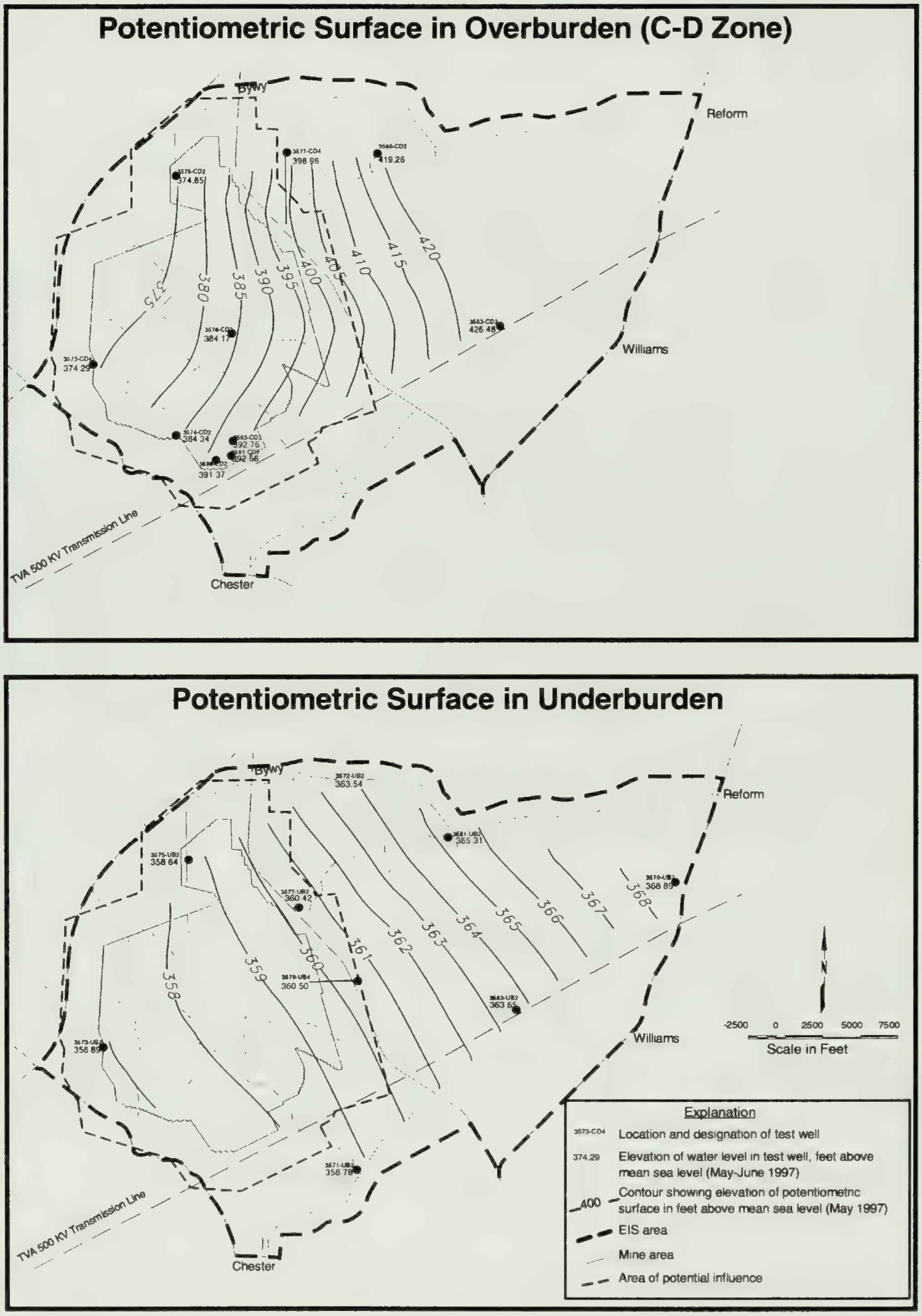


Figure 3.5.1-1 Groundwater potentiometric surfaces in overburden and underburden sediments.

The LWA is separated from the TAS by about 1,900 ft of sediments associated with (in descending order) the Midway Group, the Selma Group, and the Eutaw and McShan formations. Geophysical data for Test Hole 1 (Figure 3.3.2-3) indicate the Midway Group consists of about 650 ft of predominantly clay sediments. The Selma Group is about 780 ft thick. It primarily contains fine sands in the upper section and becomes progressively more clayey in the basal section. The Eutaw-McShan consists of interbedded sands and clays having a total thickness of about 470 ft. The top of the TAS is about 2,350 ft deep in Test Hole 1. TAS sediments extend beyond the full depth of the test hole (3,445 ft) to an estimated depth of about 4,050 ft. Sediments between depths of 2,350 and 3,300 ft belong to the Tuscaloosa Group and are characterized by thick sand beds separated by occasional clay breaks. The combined sand thickness within this interval is about 600 ft. The Lower Cretaceous sediments lying below the 3,300-ft depth consist of relatively thin sand beds with frequent clay breaks. Based upon comparisons of Test Hole 1 geophysical logs with logs for other TAS wells in the region having measured aquifer properties, the USGS estimated a transmissivity of 50,000 to 60,000 ft^2/d for the TAS in the project area (letter dated June 19, 1997, from C. Griner to J. Meadows, appearing in R.W. Harden and Associates 1997). Storativity of the TAS has not been measured in the project area, however a value of 0.0002 is considered typical for the region (R.W. Harden & Associates 1997). Measured potentiometric levels in Test Hole 1 ranged from 397 to 400 ft below grade or from elevation 191 to 194 ft above msl.

3.5.2 Groundwater Quality

Baseline groundwater quality data for the RHPP area is summarized in Appendix C-13. Wilcox groundwater quality is represented by data for 21 test wells sampled within the project area. Twelve of these wells were sampled quarterly for a comprehensive list of constituents beginning in November 1996. Nine test wells, all located within the proposed mine area of the first five years of mine operations, were sampled quarterly since June 1997, for an abbreviated list of constituents. Appendix C-13 also provides summary water quality data for 50 springs emanating from Wilcox sediments based on a single sampling event conducted in April and May 1997.

Groundwater from Wilcox sand zones is generally fresh with total dissolved solid (TDS) concentrations averaging less than 180 mg/L. This water is a calcium-sodium bicarbonate type, having near-neutral pH. Secondary drinking water maximum contaminant levels (MCLs) were frequently exceeded for iron and manganese, and occasionally exceeded for pH and aluminum. Only two Wilcox groundwater samples showed primary MCL exceedences: one for arsenic and one for beryllium. Wilcox spring water samples were generally less mineralized and more acidic than the Wilcox groundwaters. Spring waters met all primary drinking water standards, but frequently exceeded the secondary MCLs for iron, manganese, and pH.

TAS groundwater quality data was sampled from three separate zones in Test Hole 1. This water is a highly mineralized, sodium chloride-bicarbonate type with TDS concentrations exceeding 900 mg/L and chloride averaging 417 mg/L. TAS water samples showed no primary drinking water standard exceedences, but exceeded secondary standards for chloride, iron, and manganese.

3.5.3 Groundwater Use

Groundwater development in Choctaw County is limited to aquifers of the Wilcox Group, particularly the LWA. The LWA is the source of water for several public water supply systems in Choctaw County including the Town of Ackerman, NPS Natchez Trace Parkway, French Camp Academy, and the Weir, Reform, French Camp, Simpson, Panhandle, and Union Water Associations. The Town of Ackerman and the Weir and Panhandle Water Associations also obtain some water from the MWA. In addition, numerous private domestic and stock supplies are obtained from the Wilcox in Choctaw County. Total groundwater development in Choctaw County from public water supply systems is estimated at slightly over 2 mgd, with most of this water being produced from the LWA. Currently, aquifers below the LWA are not used in Choctaw County.

Figures 3.5.3-1 and 3.5.3-2 show the locations of wells and springs in and adjacent to the RHPP site. Although there are numerous private water wells in the area (Table 3.5.3-1), most have been abandoned or are no longer used. Instead, most residents obtain water from either the Union or Reform Water Associations. Of the four public supply wells inventoried, three belong to the Weir Water Association and one is operated by the NPS Natchez Trace Parkway. Only seven actively-used wells were identified in the proposed mining area. Based on reported well depths, all inventoried wells in the project area are developed in the MWA or LWA.

Figure 3.5.3-1 Locations of water wells in project vicinity.

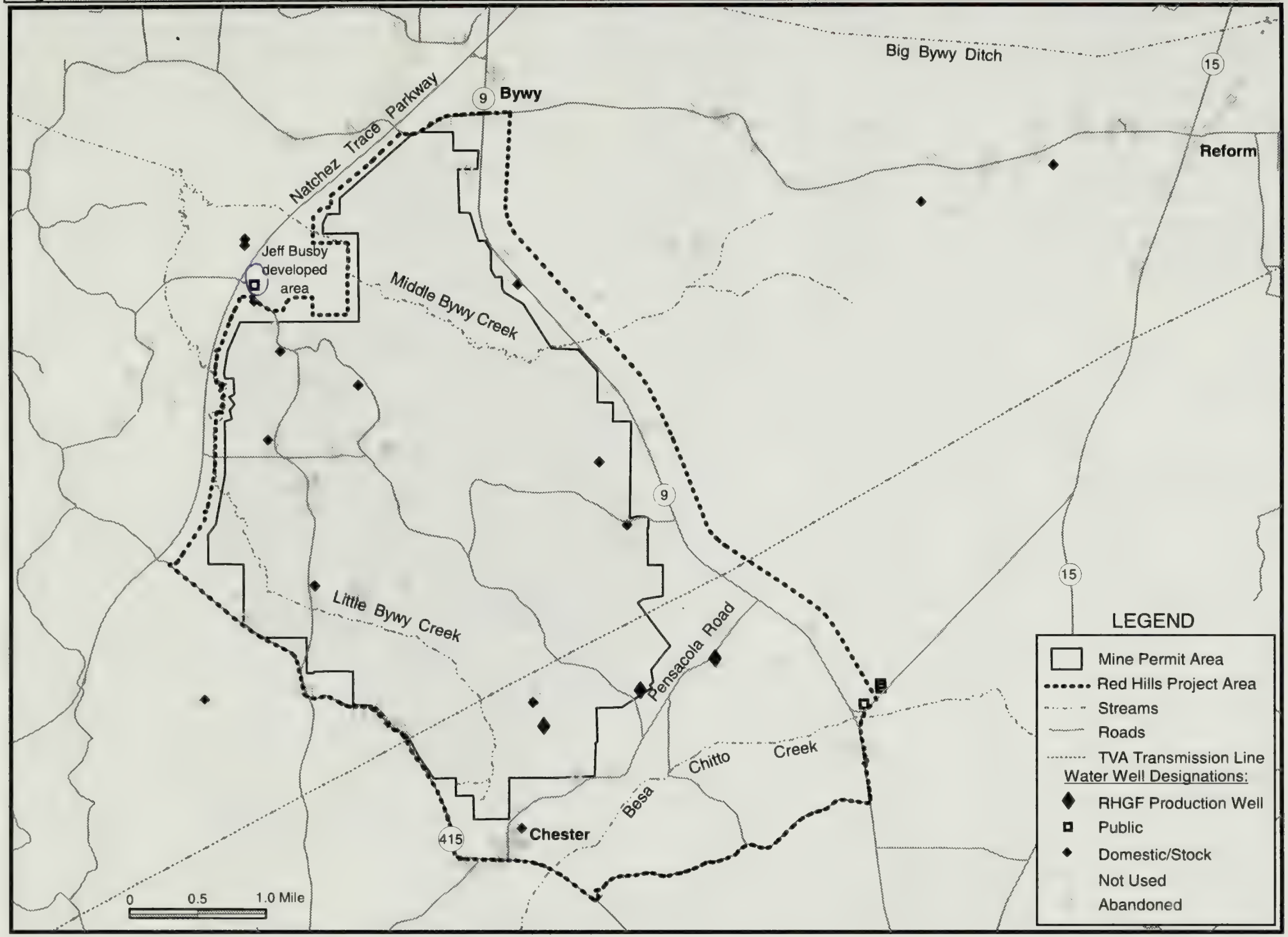


Figure 3.5.3-2 Locations of springs in project vicinity.

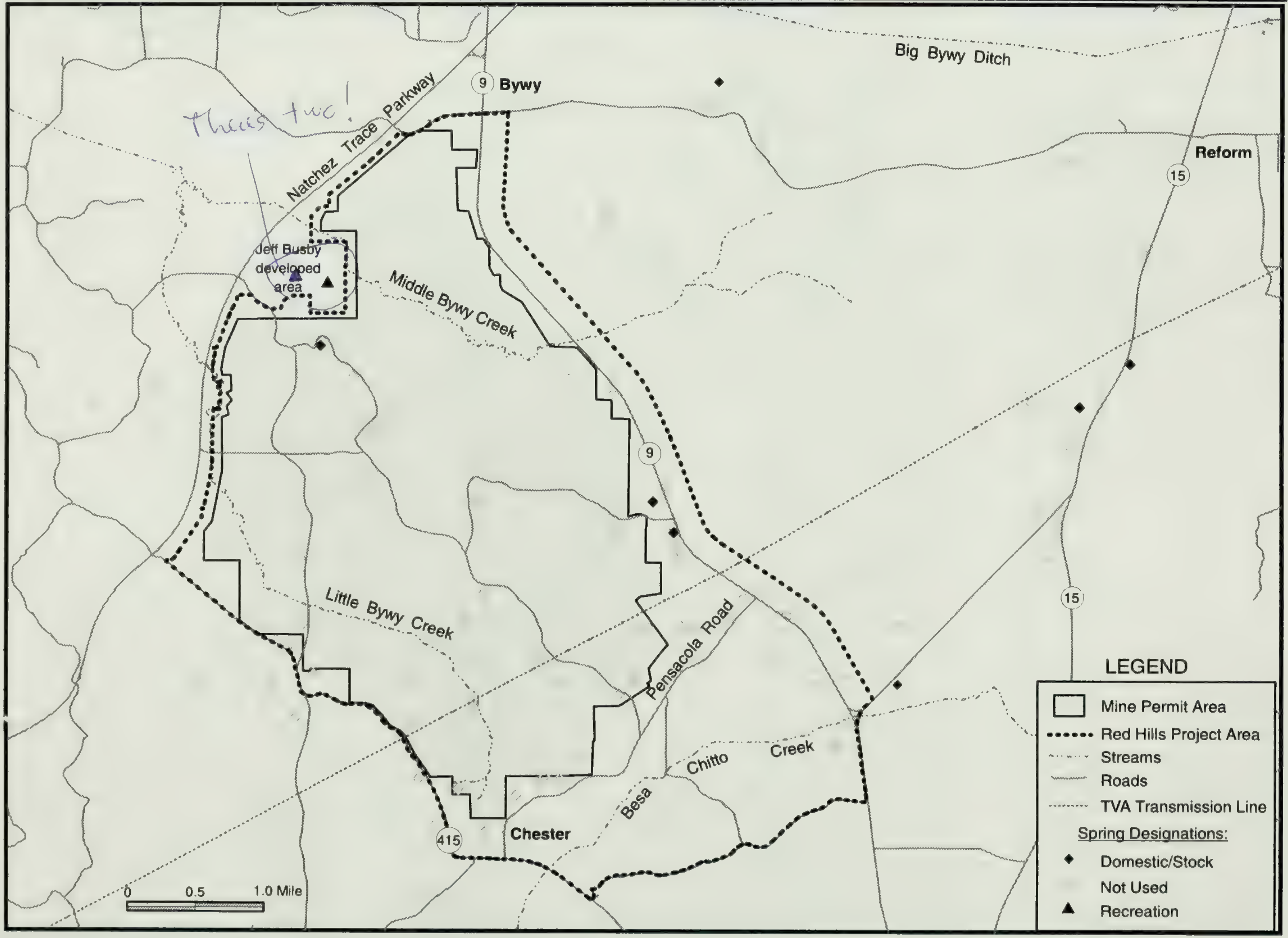


Table 3.5.3-1 Summary of Well and Spring Inventory Results

Use	Wells		Springs	
	No.	Percent of Total	No.	Percent of Total
Not Used	119	71	82	91
Abandoned	29	17	0	0
Domestic	14	8	5	6
Stock	1	1	2	2
Public Supply	4	3	0	0
Recreation	0	0	1	1
Total	167	100	90	100

Source: MLMC (1997)

Of the 90 springs identified in the project area, only eight are currently used as water supplies (Table 3.5.3-1). Fourteen of the springs had no measurable flow when surveyed. Most other springs have low flows averaging about 9 gpm (MLMC 1997).

Due primarily to the poor water quality and great depth of occurrence, there are currently no permitted TAS wells in Choctaw County. The closest TAS wells to the project site are located in bordering Webster and Oktibbeha Counties. Total permitted TAS pumpage in Webster County is approximately 0.66 mgd, while in Oktibbeha County TAS pumpage is 11.91 mgd (R.W. Harden and Associates 1997).

3.6 Surface Water Resources

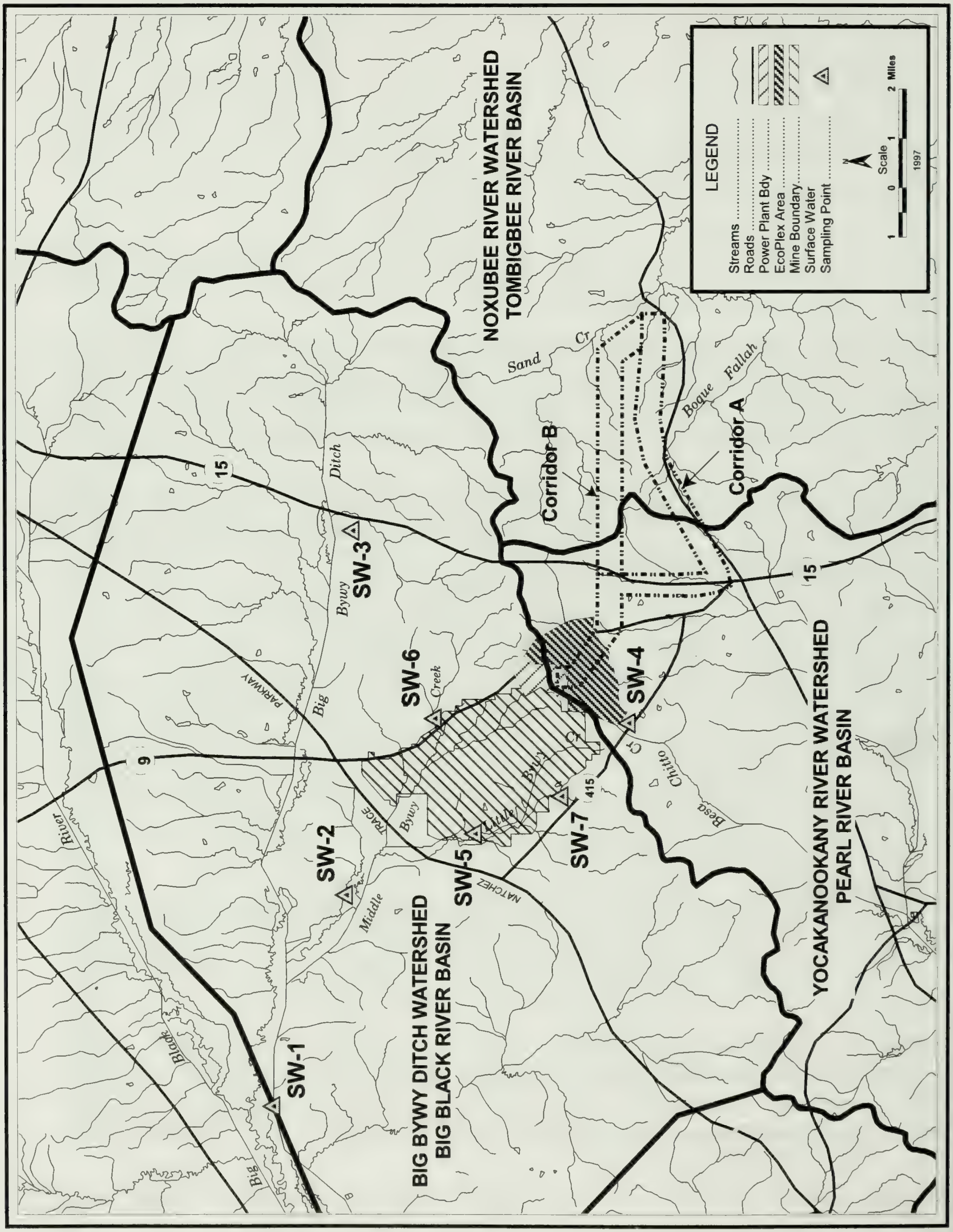
3.6.1 Watershed Characteristics

The RHPP area is drained by tributaries of three major river systems (Figure 3.6.1-1). Most of the streams draining the proposed mine site flow northwest into the Big Black River, which empties into the Mississippi River near Vicksburg, Mississippi. Project area streams in this watershed include Little Bywy Creek, Middle Bywy Creek, Big Bywy Ditch, and Stewart Creek. The southern end of the proposed mine site and the proposed generation facility site are drained by Besa Chitto Creek, a major tributary to the Yockanookany River. The Yockanookany flows into the Pearl River, which flows south to the Gulf of Mexico. Several streams in the area of the proposed transmission lines and natural gas line, including Bogue Fallah, Boughenia Creek, and Sand Creek, are tributaries to the Noxubee River, which empties into the Tombigbee River near Gainesville, Alabama.

Baseline surface water quantity and quality data were collected from December 1996 through November 1997 for streams in the project area. Seven sites were monitored, including three on Middle Bywy Creek (SW-1, SW-2, and SW-6), two on Little Bywy Creek (SW-5 and SW-7), one on Stewart Creek (SW-3), and one on Besa Chitto Creek (SW-4). Monitoring sites are shown on Figure 3.6.1-1.

In addition to this surface water monitoring, a surface water inventory was conducted to collect information on surface water uses. Information collected included, where possible, surface impoundment location, owner, approximate surface area and volume of impoundment, and water quality information. The following sections summarize the results of these studies.

Figure 3.6.1-1 Watershed map.



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

3.6.1.1 Water Quantity

The four main project area streams (Little Bywy Creek, Middle Bywy Creek, Stewart Creek, and Besa Chitto Creek) are characterized by relatively steep headwaters draining into much flatter drainage channels. Flow is intermittent in the headwater areas. Streams are fed by small intermittent and ephemeral springs. These springs discharge perched groundwater from shallow sands overlying clay strata at points where the base of the sands intersect surface topography. Further downstream and within the project area, Little ~~Bywy Creek, Middle Bywy Creek~~, Stewart Creek, and Besa Chitto Creek become perennial. A summary of flow measurements is listed in Table 3.6.1.1-1.

Table 3.6.1.1-1 Summary of Flow Measurement Data

Station ID	Minimum Flow Measurement (cfs)	Maximum Flow Measurement (cfs)	Average of Flow Measurements (cfs)	Drainage Area (acres)	Average Discharge per Unit Area (cfs/mile^2)
SW-1	5.64	189.59	45.9	18,830	1.6
SW-1*	5.24	4435	89.8	18,830	3.1
SW-2	1.18	37.54	10.9	8,097	0.9
SW-3	1.31	5.26	3.6	3,005	0.8
SW-4	1.34	6.88	4.1	3,829	0.7
SW-5	6.89	11.45	9.1	6,892	0.8
SW-6	1.47	5.79	3.6	2,968	0.8
SW-7	1.03	1.24	1.1	665	1.1

*continuous recorder data

Selected USGS Stations[1] within the vicinity of the study area watersheds were analyzed to characterize general runoff conditions (Plunkett et al. 1996). The mean flow per unit area for the USGS stations in the vicinity of the project area varies from 1.32 to 1.75 cfs/mile^2. During the period of record, the flow per square mile in the project area streams varied from 0.7 to 3.1 cfs/mile^2 (Table 3.6.1.1-1). This relatively wide range reflects normal variation of flow associated with base flow and storm flow conditions encountered during baseline data collection. It also reflects a difference in average flow resulting from use of different types of instruments and methods (continuous versus instantaneous). If the 1996 to 1997 monitoring was carried out over a longer time period, the results would be expected to approach the long-term USGS values.

To further characterize study area watersheds, rainfall-runoff simulations were performed for storm events with a duration of 24 hours and different return periods. These simulations were performed using the COE HEC-1 flood hydrograph model (USCOE 1990). Table 3.6.1.1-2 lists the calculated peak flows

1 USGS Station #07289350 (Big Black River at West, MS), 02484000 (Yockanookany River near Kosciusko, MS), 02441390 (Tombigbee River at Columbus Lock and Dam, near Columbus, MS), 02448000 (Noxubee River at Macon, MS), and 02481880 (Pearl River at Burnside, MS)

and total runoff volumes for the project area watersheds resulting from the modeled precipitation events.

Table 3.6.1.1-2 Storm Event Peak Flows and Runoff Volume Modeling Results for Project Area Watersheds					
Storm Event:	1	2	3	4	5
Return Period (yrs):	2	10	25	50	100
Duration (hrs):	24	24	24	24	24
Rainfall Depth (in.):	3.6	6.2	7	7.9	8.6
Station No.	Storm Event Peak Flows (cfs)				
SW-1	3,535	9,914	12,429	15,406	17,725
SW-2	2,436	7,750	9,574	11,887	13,576
SW-3	1,164	3,342	4,076	4,921	5,587
SW-4	1,209	3,466	4,233	5,116	5,814
SW-5	1,703	5,899	7,328	9,038	10,368
SW-6	1,182	3,628	4,465	5,432	6,198
SW-7	260	913	1,142	1,409	1,622
Station No.	Storm Event Runoff Volume (ac-ft)				
SW-1	1,547	4,360	5,410	6,614	7,568
SW-2	721	2,001	2,443	2,957	3,366
SW-3	297	791	960	1,155	1,310
SW-4	379	1,007	1,221	1,469	1,666
SW-5	517	1,535	1,895	2,315	2,650
SW-6	265	734	895	1,084	1,233
SW-7	47	144	178	218	250

3.6.1.2 Water Quality

Results of the water quality monitoring program from December 1996 through May 1997 are summarized in Appendix C-14. Constituents of particular importance for surface coal mines include acidity, alkalinity, pH, total suspended solids (TSS), total iron, total manganese, and total dissolved solids (TDS).

+ hardness for hardness-dependent crit. like metals?

All of the stream stations, SW-1 through SW-7, exhibit waters with very similar water quality and with very small seasonal variations. The data are also consistent with historical data for the region (Bednar 1980, and Kalkhoff 1983). Acidity is very low with all values equal to or less than 1 mg/L. Alkalinity is also low with values generally between 10 and 20 mg/L. Field pH values are consistently within the range of 6.1 to 7.4. Recorded TSS concentration, which typically increase with discharge rate in response to storm runoff, varied from 4 to 52 mg/L. TDS concentration varied from 20 to 80 mg/L. Total iron concentration varied from 1.02 to 2.72 mg/L. Total manganese concentration varied between 0.03 and 0.26 mg/L. Water quality monitoring for numerous organic pollutants did not detect the presence of any of these constituents. Overall, the area streams have low acidity, low TDS, and neutral pH.

Water quality in the surface impoundments within the project area is generally similar to that of the streams. TDS is low (generally less than 100 mg/L) and pH ranged between 5.5 and 8.8. However, the

surface impoundment data does show a larger range in acidity (1 mg/L to 22 mg/L) compared to data for the streams (equal to or less than 1 mg/L).

odd acidity in ponds [illegible] aluminum?

3.6.1.3 Surface Water Use

Surface waters within the project vicinity have been inventoried. A total of 110 surface impoundments were identified, and their locations are shown in Figure 3.6.1.3-1. The impoundments are generally small (less than an acre in size). A few ponds are used for stock watering purposes.

Permitted surface water users in Choctaw County include the Town of Ackerman (Permit Nos. MS-SW-00125 and MS-SW-00126 on the Pearl River) and the USDA Forest Service (Permit No. MS-SW-00595 on Noxubee Creek). These permits are not for consumptive use. No permitted surface water users withdraw water from streams in Choctaw County within or downstream of the project area.

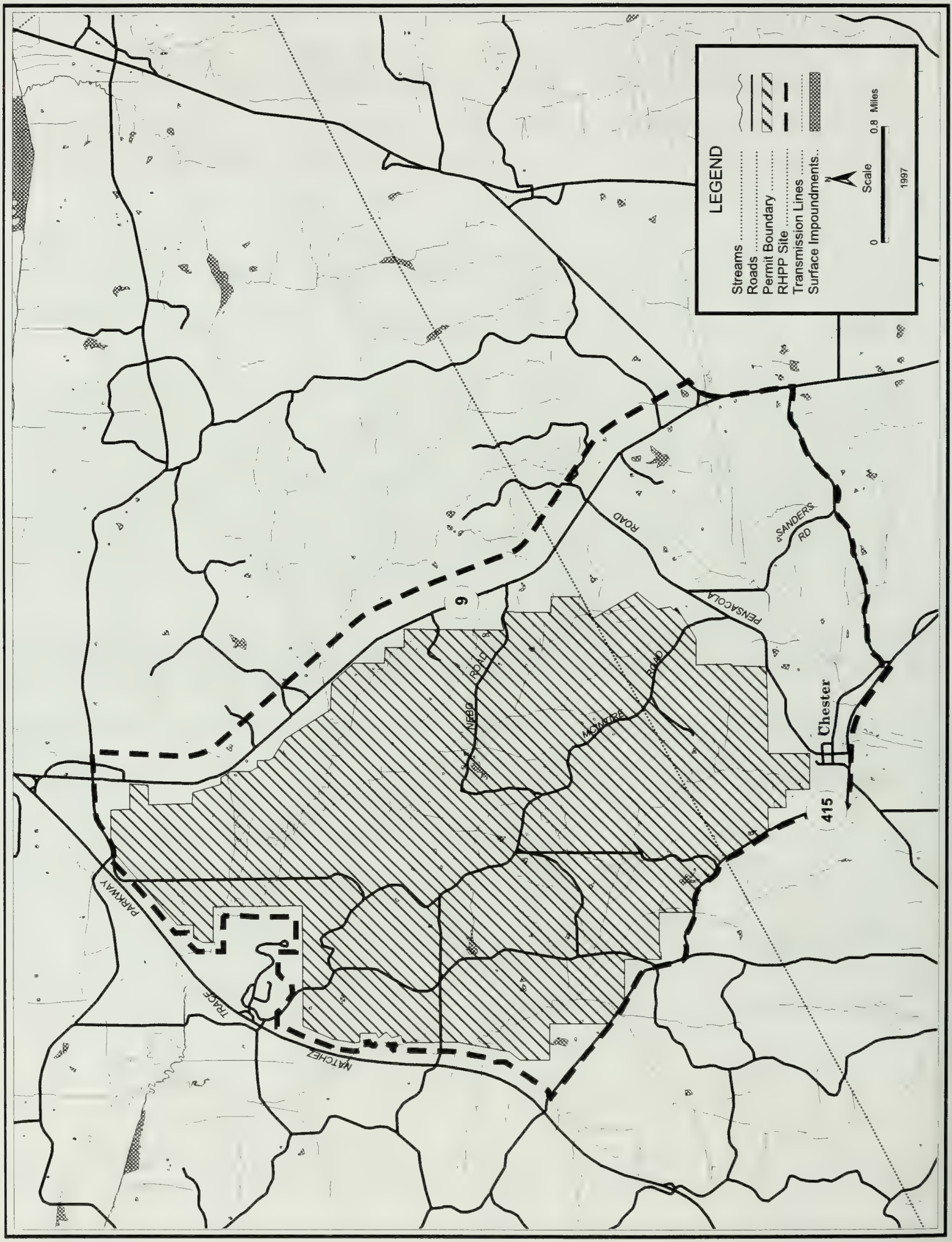
None of the streams or impoundments within the project area are specifically listed in Section IV of the state of Mississippi's Water Quality Criteria for Intrastate, Interstate, and Coastal Waters (MDEQ 1995). All unlisted waters are classified for fish and wildlife, which includes use as secondary contact recreation (incidental contact of the water, including wading and occasional swimming). Streams classified as ephemeral do not necessarily need to meet fish and wildlife standards, but none of the streams in the project area have been specifically designated as ephemeral by the State. Specific standards for all waters and those designated for fish and wildlife are summarized in Table 3.6.1.3-1. In addition to these standards, numeric criteria for toxic pollutants must also be met (MDEQ 1995).

Table 3.6.1.3-1 State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters Minimum Standards Applicable to All Waters, Fish, and Wildlife (Source: MDEQ 1995)

Parameter	Maximum	Monthly Average/Mean	Minimum
Dissolved Oxygen Daily Average Instantaneous			 5.0 mg/L 4.0 mg/L
pH Change	9 1.0		6.5
Temperature Rise	90 ºF 5 ºF		
Fecal Coliform May-Oct Nov-Apr	 400/100mL for 10% of monthly sample 4,000/100mL for 10% of monthly sample	 200/100mL 2,000/100mL	
Specific Conductance	1,000 μmhos/cm		
Dissolved Solids	1,500 mg/L	750 mg/L	
Phenolic Compounds	0.300 mg/L		

* many others (metals organics, etc)

Figure 3.6.1.3-1 Surface Impondments



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

Comparison of baseline data indicate that these water quality standards are met with exceptions of occasional pH values less than 6.5 for both streams and impoundments, and oxygen values less than 4 mg/L for a few impoundments. Most toxic pollutants were below analytical detection limits. Toxic pollutants that were occasionally detected at low concentrations included phenols (SW-1, SW-2, and SW-3), lead (SW-3), and zinc (SW-1, SW-2, SW-3, and SW-4). These occurrences were below the listed criteria for potential acute and chronic effects with the possible exception of lead, which was detected at a concentration of 10 μg/L on January 23, 1997, at SW-3. The acute and chronic criteria for lead for waters with a hardness of 50 mg/L or less are 30 and 1.18 μg/L, respectively, which are applied at the seven-day average low stream flow with a ten-year occurrence period. Additional data would be needed to determine whether the lead criterion is exceeded; however, SW-3 is located on Stewart Creek, which is outside the mine boundary and should not be affected by the project.

The Mississippi Department of Environmental Quality lists Big Bywy Ditch in Choctaw County and the Yockanookany River in both Choctaw and Attala Counties as impaired for some uses (MDEQ 1996). Both rivers are considered to be impaired for aquatic life support due to pesticides, nutrients, siltation, and organic enrichment/low dissolved oxygen. Agricultural runoff from the numerous farms within the area is the suspected primary source. In addition, fish consumption is considered to be impaired due to metals in the Yockanookany River. The MDEQ assessment is currently based on professional judgment without supporting monitoring data. The listings indicate a need for judicious planning for additional growth in the area to preclude further degradation of the streams.

3.7 Aquatic Ecology

As described in Section 3.6, the RHPP area is drained by tributaries of three major river systems. All of the streams flowing northwest from the project area drain into the Big Black River, which empties into the Mississippi River near Vicksburg, Mississippi. The streams in this watershed receive runoff from virtually all of the proposed mine site, and include McCurtain, Big Bywy Ditch, Middle Bywy Creek, Little Bywy Creek, Stewart Creek, and several other small tributaries. Streams that drain the project area toward the southwest are parts of the Yockanookany River, a tributary of the Pearl River which flows south to the Gulf of Mexico. The largest stream in the Red Hills part of this watershed is Besa Chitto Creek, which carries runoff from the area where the generation facility would be built. Some of the streams along the eastern end of the transmission line corridor are tributaries of the Noxubee River, which empties into the Tombigbee River near Gainesville, Alabama. Sand Creek, the largest Noxubee River tributary in this area, flows near the transmission substation, west of Sturgis.

Aquatic habitats in most of these streams are quite similar. Sand is the predominant substrate in nearly all of them, and scattered woody debris (brush piles, log jams, tree roots, and stumps) is also common. Gravel riffles are present in a few streams, and outcrops of consolidated clay or sand can also be found. Low-lying areas have been impounded behind beaver dams throughout the area. Portions of some area streams (especially in the Big Black watershed) were channelized about 50 years ago (Table 3.7.1-1), and reasonably stable aquatic habitat and riparian zones (Section 3.10.1) have reestablished. Specific sites on several of these streams also have been affected by recent bridge replacements.

Very little existing information was available to help characterize the aquatic ecology of streams in the vicinity of the Red Hills project. The Mississippi Department of Environmental Quality conducts sampling on McCurtain Creek as part of their state-wide reference stream program. As a part of this evaluation, specific field studies were conducted to identify the major components of the benthic and fish communities in these streams. Aquatic species were sampled at 30 sites (Table 3.7.1-1) in streams within and surrounding the RHPP site, including two sites on the Natchez Trace Parkway.

3.7.1 Benthic Communities

Qualitative benthic macroinvertebrate samples were collected from 18 sites on ten streams (Table 3.7.1-2). Samples were collected in April and July 1997, following standard procedures. A D-net was used to collect invertebrates from all discernible habitat types (e.g., leaf packs, root wads, rocks/wood, sediment) encountered at each site. At the time of collection, all recognizable taxa from each habitat were preserved in formaldehyde for subsequent laboratory identifications to the lowest practicable taxa (Pennington and Associates, Cookeville, Tennessee).

Overall results of benthic macroinvertebrate sampling are summarized in Table 3.7.1-2. Macroinvertebrate faunal diversity was dominated by the order Diptera (two-winged flies), represented by 58 taxa in 30 samples from the Big Black River basin and 18 taxa in four samples from the Yockanookany basin. Other insect orders present in appreciable number in the Big Black basin included Coleoptera (beetles, 25 taxa), Odonata (dragonflies and damselflies, 23 taxa), and Ephemeroptera (mayflies, 19 taxa). Total taxa collected in Big Black basin samples was 184, including 41 EPT [Ephemeroptera, Plecoptera (stoneflies), and Trichoptera (caddisflies)]. Sixty taxa, including eight EPT taxa, were found in Yockanookany basin samples where lower diversity is attributable to lower sampling effort. Spring and summer samples showed similar occurrences of dominant orders, although there were seasonal variations in discernible taxa (Appendix C-15, Tables C-15.1 and C-15.2).

Macroinvertebrate diversity was closely related to habitat diversity, and sites containing rooted vegetation and substrate heterogeneity (e.g., natural gravel or rubble from bridge construction) exhibited the most dense and diverse fauna. Terrestrial plant debris (leaf pack, logs, root wads, etc.) was also important in providing macroinvertebrate habitat.

No benthic macroinvertebrate collections were made along the proposed transmission line corridors in the Yockanookany and Noxubee River basins. The relatively minor impact of transmission lines on benthic macroinvertebrates compared to proposed mining activities near the generation facility site diminished the need for collections there.

Table 3.7.1-1 Stream Benthic Macroinvertebrate, Mussel, Crayfish, and Fish Sampling Sites and Dates in the Vicinity of the Proposed RHPP Site, including two sites on the Natchez Trace Parkway, Choctaw County, Mississippi, Fall 1996 - Summer 1997

Station Number	Stream	Site	Sampling Target and Date*: Benthic Macro-Invertes	Mussels	Crayfish, Fish	Comments
	Big Black River Basin					
1	Big Bywy Ditch	MS 15	4/2, 7/22	4/2, 7/22	4/2	extensive channelization
2	Stewart Creek	Sturgis-Reform Rd.	4/2, 7/22	7/22	4/2	portions channelized
3	Big Bywy Ditch	MS 9	4/1, 7/22	10/10/96, 4/1, 7/22	4/2	extensive channelization
4	Swamp, off Big Bywy Ditch	Hebron Rd.	4/10	--	4/10	no channelization
5	Big Bywy Ditch	Chester-Tomnolen Rd.	4/3	--	4/3	extensive channelization
6	Middle Bywy Creek	MS 9	4/9, 7/24	--	4/9	extensive channelization
7	Middle Bywy Creek	Prewitt Rd.	4/3, 7/25	--	4/3	extensive channelization
8	Log Branch	Prewitt Rd.	4/3, 7/25	--	4/3	extensive channelization
9	Middle Bywy Creek	Natchez Trace Pky.	4/2, 7/23	4/2, 7/23	4/2	extensive channelization
10	Middle Bywy Creek	Bywy Rd.	4/9, 7/22	7/22	4/9	extensive channelization
11	Jenkins Creek	Chapel Hill Rd.	4/8, 7/23	7/23	4/8	portions channelized
12	Little Bywy Creek	Salem-Bywy Rd.	4/3, 7/24	--	4/8	not channelized
13	Bowie Branch	MS 415	4/8, 7/23	--	4/8	not channelized
14	Little Bywy Creek	Natchez Trace Pky.	4/2, 7/23	7/23	4/2	not channelized
15	McCurtain Creek	Watson-Bankston Rd.	4/8, 7/24	7/24	4/8	not channelized
16	McCurtain Creek	Tally Rd.	4/8, 7/24	4/8, 7/24	4/8	not channelized
	Yockanookany River Basin					
17	Besa Chitto Creek	MS 9 @ the "Y"	4/1, 7/22	4/1, 7/22	4/1	portions channelized
18	Besa Chitto Creek	Stewart Rd.	4/8, 7/23	--	4/8	portions channelized; beaver dams at site
	Besa Chitto Creek	Sanders Rd.	--	--	6/4	portions channelized
	Besa Chitto Creek	Weir	--	7/23	--	portions channelized
	unnamed trib.	MS 12	--	--	6/4	portions channelized
	unnamed trib.	MS 9	--	6/3	6/3	portions channelized
	unnamed trib.	MS 415	--	--	6/4	portions channelized
	unnamed trib.	Mabus Rd.	--	--	6/4	portions channelized
	Noxubee River Basin					
	Sand Creek	Phillips Rd.	--	7/24	6/3	not channelized
	Sand Creek	Louisville Rd.	--	7/24	--	not channelized
	Horse Branch	Wood Rd.	--	7/24	6/3	not channelized
	unnamed trib. to Boughenia Cr.	MS 12 @ RR trestle	--	--	6/4	not channelized
	unnamed trib. to Boughenia Cr.	MS 12 E. of Fulcher	--	--	6/4	not channelized
	unnamed trib. to Bogue Fallah	MS 12 W. of Bethlehem Rd.	--	--	6/4	not channelized

*All dates 1997 unless specified otherwise

A total of eleven decapod crayfish taxa were collected during fish surveys in the combined sampling areas of the three river basins (Table 3.7.1-3), according to identifications made by Dr. J. F. Fitzpatrick, Jr. (University of South Alabama, Mobile). More taxa were found in the Noxubee basin (8), than the Yockanookany (6) and Big Black (5) basins. According to Dr. Fitzpatrick, none of the taxa are federally listed as threatened or endangered. Although one taxon, *Orconectes (Hespericambarus) hartfieldi*, was designated as threatened by Taylor et al. (1996).

Table 3.7.1-2 Summary of Benthic Macroinvertebrate Orders and Number of Taxa Found in the Vicinity of RHPP Locations in Qualitative Samples During April and July 1997.

	Big Black River Basin	Yockanookany River Basin	Noxubee River Basin	Totals
(Sites Surveyed)	(30)	(4)	(0)	(34)
Class				
Order				
Nematamorpha	1			1
Nematoda	1			1
Turbellaria				
Tricladia	1			1
Oligochaeta				
Haplotaxida	3	2		3
Lumbriculida	2	1		2
Branchiobdellida	1			1
Hirudinea				
Pharyngobdellida		1		1
Crustacea				
Isopoda	2	1		2
Amphipoda	2	1		2
Decapoda	5	4		5
Insecta				
Collembola	1			1
Plecoptera	8	3		8
Odonata	23	7		24
Ephemeroptera	19	3		19
Hemiptera	10	2		10
Trichoptera	14	2		14
Megaloptera	4	1		4
Diptera	58	18		60
Coleoptera	25	11		26
Arachnoidea				
Acariformes	1			1
Gastropoda				
Basommatophora	1	1		1
Mesogastropoda	1			1
Bivalvia				
Unionida	1			1
Veneroida	2	2		3
Number of taxa	184	60		192
Number of EPT taxa	41	8		41

Seven crayfish taxa were encountered in streams in the proposed mine area (Appendix C-15, Table C-15.3), while seven taxa were identified from streams within the proposed transmission line

corridors (Appendix C-15, Table C-15.4). Consult Appendix C-15 for taxa collected at individual sampling sites.

Table 3.7.1-3 Summary of Crayfish Taxa Found (Sites of Occurrence) in the Vicinity of RHPP Locations Between April and June 1997 (Identifications by J. F. Fitzpatrick, Jr., University of South Alabama)

(Sites Surveyed)	Big Black River Basin (16)	Yockanookany River Basin (7)	Noxubee River Basin (5)	Totals (28)
Species				
Cambarus (Depressicambarus) striatus	1	3	2	6
Cambarus (Lacunicambaras) diogenes			1	1
Orconectes (Buannnulifictus) hobbsi		1		1
Orconectes (Hespericambaras) hartfieldi			1	1
O. (Trisellescens) sp., ref.: *etnieri*	5		3	8
Procambarus (Ortmannicus) acutissimus			1	1
Procambarus (O.) acutus	6	2		8
P. (O.) acutus VAR	2	6	1	9
P. (O.) hybus		1		1
P. (O.) viaeviridis			1	1
P. (Pennides) vioscai paynei	11	2	3	16
Crayfish Taxa Encountered	5	6	8	11

The freshwater mussels are one group of macroinvertebrates which are extremely difficult to locate using general sampling techniques. To add these species to the information base, native mussels present in the larger streams near the project area were surveyed in July 1997. During this survey, aquatic biologists used rakes and tactile searching techniques to locate live and empty shells of any mussel species which were present. Staff at the Mississippi Museum of Natural Science assisted in determining species-level identifications for all of the usable mussel material encountered during the mussel survey during other aquatic site visits when mussels were found.

Results of the mussel survey are summarized in Table 3.7.1-4 and are presented in detail in Appendix C-15, Table C-15.5. The 205 live and dead mussels encountered at the 14 sampling sites represented a total of 14 species. Only two of these species were found in more than one of the river systems (*Villosa lienosa* was found in all three river systems, and *Strophitus radiatus* was found in the Big Black and Noxubee systems). The most species (11) were found in the Big Black River system, possibly because more sites were surveyed in that system (8) and some of those sites were on relatively larger streams (especially Big Bywy Ditch and McCurtain Creek). While relatively few mussel collections have been made in this area, comments from the Mississippi Museum of Natural Science staff indicate that none of these records are particularly surprising for this part of the state.

Table 3.7.1-4 Summary of Live and Empty Freshwater Mussel Shells Found in the Vicinity of RHPP Locations between October 1996 and July 1997

(Sites Surveyed)	Big Black River Basin (8)	Yockanookany River Basin (3)	Noxubee River Basin (3)	Totals (14)
Species				
Anodonta grandis	5			5
Elliptio arca		4		4
Fusconaia flava	14			14
Lampsilis claibornensis		8		8
Lampsilis siliquoidea	64			64
Lampsilis straminea			4	4
Potamilus purpuratus	1			1
Quadrula quadrula	3			3
Strophitus radiatus	17		4	21
Toxolasma parvus	39			39
Toxolasma texasensis	2			2
Uniomerus tetralasmus	1			1
Villosa lienosa	21	10	2	33
Villosa sp.	6			6
Mussels Encountered	173	22	10	205
Species Included	11	3	3	14

3.7.2 Fish Communities

Fish communities were sampled at 18 sites in eight streams and one swamp in the vicinity of the proposed mine during April 1997 and ten sites on as many streams near the proposed transmission line corridors (Table 3.7.2-1). All sample sites, except one, had relatively shallow, wadeable water that could be adequately sampled without the aid of a boat. At each site, fish were collected using a backpack electrofishing unit, dip nets, and a seine. In larger streams a 20-ft seine was used, while a 10-ft seine was used in small streams. Fish, temporarily stunned by electric shock, either were swept by the stream flow into an outstretched seine or captured in dip nets. Seine hauls were made in areas of sluggish or no current. A small electrofishing boat was used to collect fish at the most downstream site on Big Bywy Ditch (Site 5), which was the only site selected with sufficiently deep water. Many of the larger individuals and species associated with larger water bodies were collected in the boat shocking sample.

Most fish were readily identifiable to the species level in the field and were released. However, voucher specimens and any unfamiliar fish species were preserved in formaldehyde and returned to the TVA lab (Norris, Tennessee) for positive identification. Following laboratory identifications and specimen enumeration, the samples were donated to Dr. Charles Knight of the Mississippi Department of Natural Sciences Museum (Jackson, Mississippi).

Diverse fish communities were found in surveys of the streams in the proposed mine area and transmission line corridors (Table 3.7.2-1). Seventy-seven species and one hybrid taxa were represented by a grand total of 8,500 individual fish. None of the species collected are federally listed as threatened

or endangered. These samples indicate an aquatic habitat that has had relatively little impact from human activities since some of them were channelized in the distant past. Mine site sampling resulted in the capture of 4,812 individuals, of 63 species, representing 15 families in the Big Black River basin. Thirty-three species were collected from the Yockanookany basin and 41 species from the Noxubee basin. The dominant families were Cyprinidae (carps and minnows), Centrarchidae (sunfishes), and Percidae (perches).

Listings of species collected at each site are given in Appendix C-15. Species abundance by sampling location on the mine site ranged from 12 in Stewart Creek to 34 in Big Bywy Ditch (Appendix C-15, Table C-15.18 and C-15.21). There were 47 species, representing ten families, found in the streams that would be crossed by the transmission corridors (Appendix C-15, Table C-15.6). Dominant families for these streams were the same as the larger streams on the mine site. Species numbers in the transmission corridor streams ranged from five to 29 (Appendix C-15, Table C-15.6 and C-15.25). Most of the species collected from both the mine site and the transmission corridors seemed to be common to the small aquatic habitats of the area.

Table 3.7.2-1 Summary of Fish Species Collected in the Vicinity of RHPP during April and June 1997

(Sites Surveyed)	Big Black River Basin (16)	Yockanookany River Basin (7)	Noxubee River Basin (5)	Totals (28)
Species				
Petromyzontidae—lampreys				
Chestnut lamprey	1			1
Least brook lamprey		1	43	44
Southern brook lamprey	25			25
Lepisosteidae--gars				
Spotted gar	4			4
Amiidae--bowfin				
Bowfin	3			3
Clupeidae--herrings				
Gizzard shad	3			3
Cyprinidae--minnows				
Bluntface shiner	475			475
Blacktail shiner	202	2	6	210
Silverjaw minnow			38	38
Clear chub	15			15
Striped shiner	533	3	98	634
Pretty shiner			312	312
Cherryfin shiner	682	780		1462
Redfin shiner	59			59
Bluehead chub	34	1	49	84
Golden shiner	72	74	1	147
Orangefin shiner			93	93
Rough shiner			793	793
Silverband shiner	2			2
Weed shiner	56	64		120
Pugnose minnow	20	42		62
Bluntnose minnow	481	156	138	775
Bullhead minnow	82			82
Creek chub	34	5	28	67

Table 3.7.2-1 Summary of Fish Species Collected in the Vicinity of RHPP during April and June 1997

(Sites Surveyed)	Big Black River Basin (16)	Yockanookany River Basin (7)	Noxubee River Basin (5)	Totals (28)
Catostomidae--suckers				
Lake chubsucker	1			1
Creek chubsucker	14	43	8	65
Spotted sucker	15			15
Blacktail redhorse	82			82
Ictaluridae--catfishes				
Black bullhead	13	1		14
Yellow bullhead	8	2	1	11
Blue catfish	1			1
Channel catfish	3			3
Tadpole madtom			2	2
Least madtom	5			5
Speckled madtom		9	20	29
Brindled madtom	175			175
Freckled madtom			7	7
Brown madtom	43			43
Esocidae--pikes				
Grass pickerel	16	7	4	27
Aphrododeridae--pirate perch				
Pirate perch	13	5	4	22
Fundulidae--topminnows				
Blackstripe topminnow	1		1	2
Blackspotted topminnow	192	93	12	297
Poeciliidae--livebearers				
Mosquitofish	81	40	10	131
Atherinidae--silversides				
Brook silversides	7			7
Centrarchidae--sunfishes				
Shadow bass			1	1
Flier	8			8
Banded pygmy sunfish	10	2	2	14
Redbreast sunfish	10			10
Green sunfish	24	12	11	47
Warmouth	25	9	2	36
Bluegill	145	32	17	194
Dollar sunfish	56	13	2	71
Longear sunfish	119	132	13	264
Redear sunfish	10	2		12
Redspotted sunfish	2		2	4
hybrid sunfish	2			2
Spotted bass	19	1		20
Largemouth bass	8	7	8	23
White crappie	3			3
Black crappie	5			5
Percidae--perches				
Naked sand darter	27			27
Southern sand darter			3	3
Scaly sand darter	9			9
Bluntnose darter		95	1	96
Slough darter	2			2
Harlequin darter	1		1	2

Table 3.7.2-1 Summary of Fish Species Collected in the Vicinity of RHPP during April and June 1997

(Sites Surveyed)	Big Black River Basin (16)	Yockanookany River Basin (7)	Noxubee River Basin (5)	Totals (28)
Tombigbee darter			61	61
Brighteye darter	75			75
Johnny darter	95		39	134
Goldstripe darter	336	18	57	411
Cypress darter	23	27	16	66
Speckled darter	252		12	264
Gulf darter	10	26		36
Redband darter			4	4
Blackbanded darter		6	55	61
Blackside darter	5			5
Dusky darter	76	1	2	79
Sciaenidae--drums				
Freshwater drum	2			2
Total collected	4812	1721	1977	8500
Total species	63	33	41	77

3.8 Wetlands

Wetland resources in the Red Hills region have suffered a marked decline as the result of channelization of major streams and the clearing of wetlands for agricultural purposes. As determined by the USDA-NRCS (USDA-SCS 1986), hydric soils comprise 7% of Choctaw County (18,390 acres) and 0.8% of the 9,300-acre study area (Table 3.4.1-1). Soils that meet hydric soils criteria within Choctaw County are classified within the Arkabutla, Chenneby, Guyton, Kirkville, Ozan, and Rosebloom series (USDA-SCS 1986). Guyton and Rosebloom are the only hydric soils that occur within the RHPP study site. These areas of hydric soils would have originally supported forested wetlands and would have been subject to periodic flooding. Past land-use changes and stream channelization have resulted in wetlands being reduced today throughout the county. The deeply cut stream channels, often 30 ft deep, allow rapid runoff of the floodplains, resulting in less frequent flooding. Current wetlands, in part, consist of areas adjacent to uplands where seepage is a factor. Also, old stream channels in the northwestern part of the study site remain wet and are vegetated with characteristic wetland species.

3.8.1 Description of Wetlands in Project Area

Wetlands in the project area were identified using aerial photos, U.S. Fish and Wildlife Service National Wetland Inventory (NWI) maps, NRCS soil surveys, and topographic maps. This identification was then verified by field surveys. Project area wetlands are illustrated in Figure 3.8.1-1; the section numbers on the figure are used as a reference system in the descriptions below.

Table 3.8.1-1 lists wetland types found in the project area. Acreage was estimated using USGS 7.5-in. topographic maps. Utilizing the Cowardin system of wetland classification (Cowardin et al. 1979), palustrine forested and palustrine emergent are the most common types. Lacustrine emergent and palustrine scrub-shrub wetlands are less common in the project area. Following is a detailed description of each wetland type.

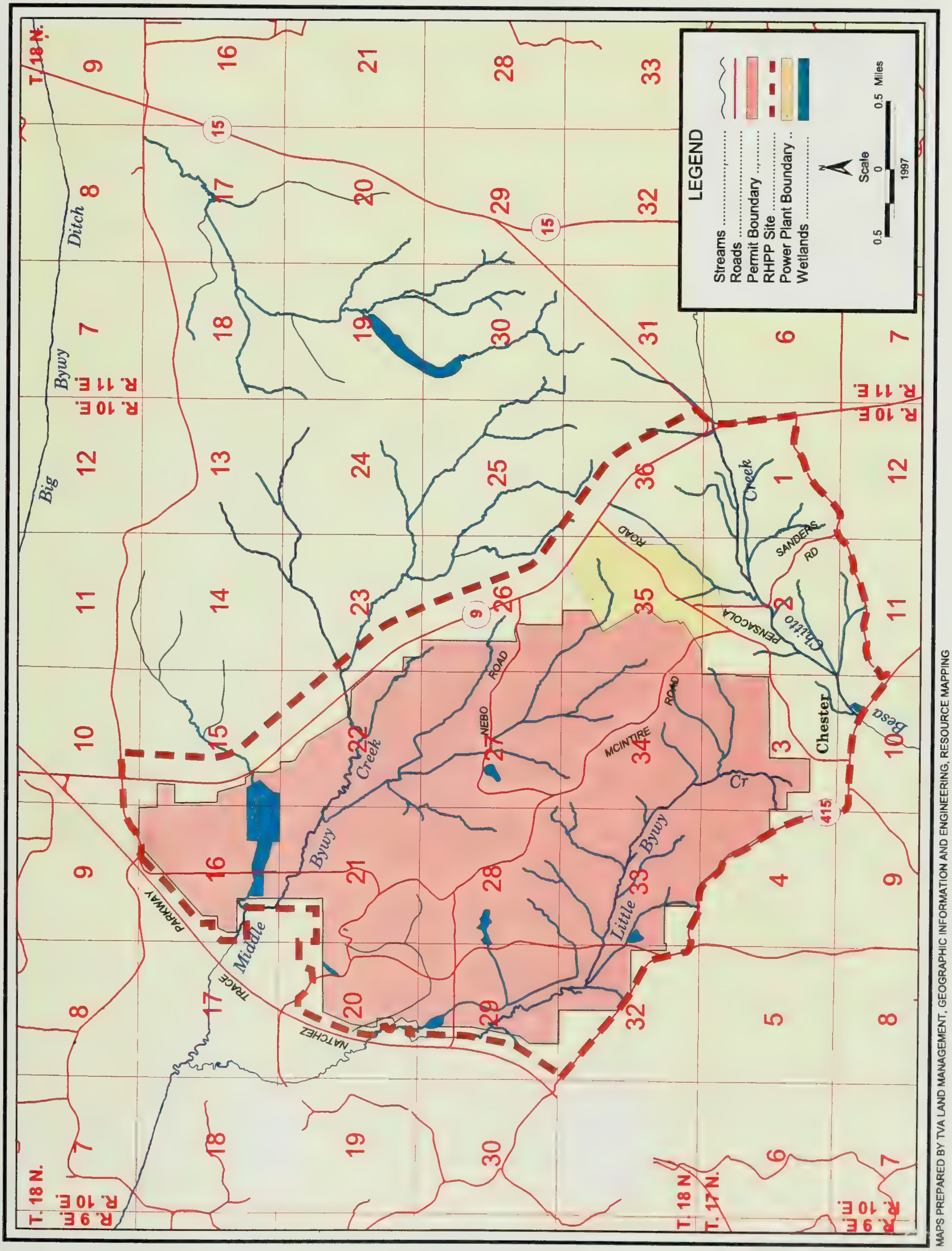
Table 3.8.1-1 Wetland Types in the Project Area

Wetland Type	Total Acreage
Lacustrine Emergent	1.5
Palustrine Emergent	14.5
Palustrine Forested	47.8
Palustrine Scrub-Shrub	3.0
TOTAL	68.1

Lacustrine Emergent Wetland

This wetland type is restricted to a small area of 1.5 acres in and around a spring-fed pond in Section 27 (Figure 3.8.1-1). Dominant plants include leathery rush (*Juncus coriaceus),* grass leaf rush, *(J. marginatus),* needlepod rush (*Juncus scirpoides),* green bulrush *(S. atrovirens),* woolgrass *(S. cyperinus),* shallow sedge *(Carex lurida),* globe beakrush *(Rhynchospora globularis),* broom panic grass (*Panicum scoparium),* sugar cane plumegrass *(Erianthus giganteus),* and netted chainfern (*Woodwardia areolata).*

Figure 3.8.1-1 Wetlands on project area.



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Palustrine Emergent Wetland

Open wetlands in which herbaceous plants are dominant occur in Sections 16 and 28 (Figure 3.8.1-1), with a total area of 10.5 acres. In Section 16, they consist of old drainage patterns in a hayfield with the southwest corner especially poorly-drained and characterized as a wetland throughout. In Section 28, the wetlands are in open marshy areas above an impoundment partially influenced by beaver activity. Dominant vegetation includes red vine (*Brunnichia cirrhosa),* panic grasses (*Panicum hians, P. microcarpon, P. scoparium),* bearded beggar-ticks *(Bidens aristosa),* climbing hempweed *(Mikania scandens),* saltmarsh camphor weed *(Pluchea camphorata),* dotted smartweed *(Polygonum punctatum),* leathery rush, fringed sedge *(Carex crinita),* ditch stonecrop *(Penthorum sedoides),* sensitive fern *(Onoclea sensibilis),* and lizard's tail (*Saururus cernuus).*

Small areas of palustrine emergent wetland also occur where small streams cross open areas such as pastures (Sections 20, 27, and 29, Figure 3.8.1-1). Agricultural land use prevents development of many dominants other than pasture grasses such as Bermuda grass (*Cynodon dactylon)* or paspalum (*Paspalus).* When other herbs occur they are primarily small-spike false-nettle (*Boehmeria cylindrica),* lizard's tail, American potato bean *(Apios americana),* and woolgrass (*Scirpus cyperinus*).

Palustrine Forested Wetland

This wetland type occurs throughout the project area along large and small streams. It is the most common wetland type with a total of 47.8 acres. In the upper stream reaches the only evidence of wetland vegetation is in the herbaceous and shrub layers; rarely do any tree species characteristic of wetlands occur. Dominants in these areas vary from site to site, depending on moisture and soil conditions, but may include cinnamon fern (*Osmunda cinnomomea),* royal fern *(O. regalis),* lizard's tail, cardinal flower *(Lobelia cardinalis),* small-spike false-nettle, and buttonbush (*Cephalanthus occidentalis).* Peat moss (*Sphagnum subsecundum)* may occur and is a good indicator species of moisture at least part of the year. Near larger streams, dominants may include American sycamore (*Plantanus occidentalis),* cherrybark oak (*Quercus pagoda),* water oak *(Q. nigra),* willow oak *(Q. phellos),* shumard oak *(Q. shumardii),* red maple *(Acer rubrum),* brook-side alder *(Alnus serrulata),* bitter-nut hickory *(Carya cordiformis),* and sweet gum (*Liquidambar styraciflua).*

Other areas of palustrine forested wetlands occur in Sections 10, 15, 16, and 36 (see Figure 3.8.1-1). These forested wetlands are diverse, with differing dominant vegetation. The areas near Highway 9 in Section 36 are dominated by swamp tupelo (*Nyssa biflora).* Areas in Section 16 consist of old stream channels in bottomland hardwoods. Dominants on the streambanks include water oak, willow oak, shumard oak, winged elm *(Ulmus alata),* American elm *(U. americana),* bitter-nut hickory, sweet gum, and tulip poplar (*Liriodendron tulipifera).* In the stream channels, dominant herbs and shrubs are buttonbush, small-spike false-nettle, jewelweed *(Impatiens capensis),* lizard's tail, and cardinal flower. In the area east of Chester (Section 10), dominants are sweetbay (*Magnolia virginiana),* laurel oak (*Quercus laurifolia),* willow oak, water oak, red maple, sweet gum, and black willow *(Salix nigra).*

Associated herbs are lizard's tail, climbing hempweed, prickley bog sedge *(Carex atlantica),* Virginia spider-wort *(Tradescantia virginica),* small-spike false-nettle, jewelweed, netted chain fern, and sensitive fern.

Palustrine Scrub-Shrub Wetlands

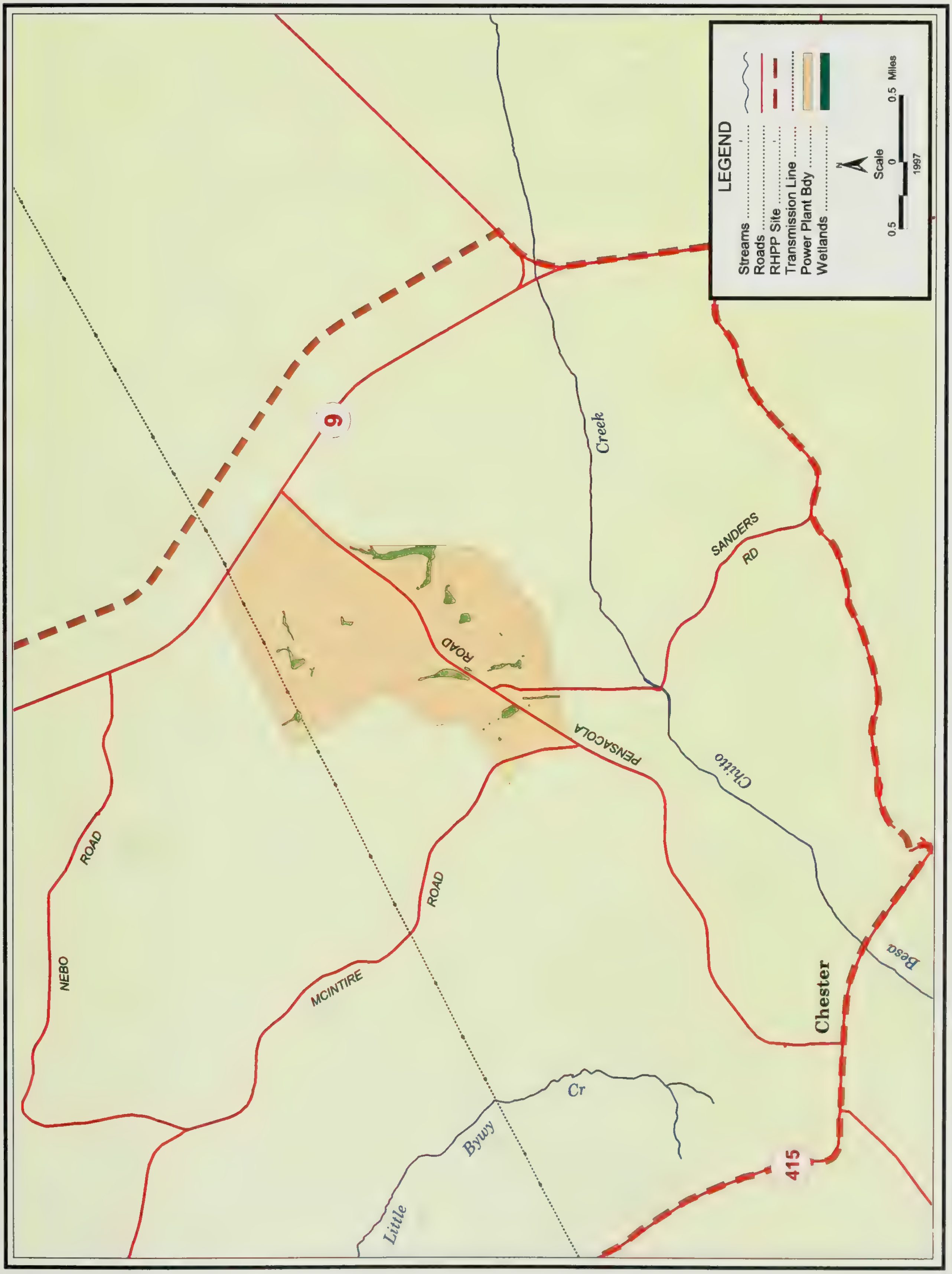
A small area (three acres) of palustrine scrub-shrub wetland occurs in Section 33 (see Figure 3.8.1-1). Seepage from the adjacent uplands is responsible for its wetland status. Dominants include buttonbush and black willow. Associated herbs are primarily small-spike false-nettle, lizard's tail, and jewelweed.

3.8.2 Description of Wetlands on the Proposed Generation Facility Site

Wetlands within the RHGF site were delineated and identified using criteria described in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979) classification system. Table 3.8.2-1 summarizes the approximate acreage and cover type of each wetland. Numbers correspond to Figure 3.8.2-1. (NOTE: Different permitting procedures are required for the proposed mine and generation facility, as discussed in Section 4.8. As a result, wetland acreage in the generation facility site is also included in the acreage estimates for the overall project area.)

Table 3.8.2-1 Characteristics of Delineated Wetlands on the Proposed Generation Facility Site		
Wetland No.	Classification	Area (Acres)
1	palustrine scrub-shrub	0.4
2	palustrine scrub-shrub	0.2
3	palustrine emergent/scrub-shrub	0.1
4	palustrine forested	0.1
5	palustrine forested	0.69
6	palustrine forested	0.24
7	palustrine forested	0.03
8	palustrine forested	0.47
9	palustrine open water	0.04
10	palustrine emergent	0.03
11	palustrine forested/ emergent	0.28
12	palustrine emergent/scrub-shrub	0.38
13	palustrine forested	0.11
14	palustrine open water	0.69
15	palustrine forested	1.39
16	palustrine emergent	0.22
17	palustrine forested/emergent	0.02
18	palustrine open water	0.51
19	palustrine emergent	0.07
20	palustrine forested	4.31
21	palustrine emergent	0.06
22	palustrine open water	0.03
23	palustrine emergent/scrub-shrub	0.31
24	palustrine forested/scrub-shrub	0.34
25	palustrine forested	0.10
26	palustrine open water	0.89
27	palustrine emergent	0.15
28	palustrine emergent	0.35
29	palustrine forested	0.15
	TOTAL	11.94

Figure 3.8.2-1 Wetlands on the proposed generation facility site.



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3.8.3 Description of Wetlands on the Proposed Mine Site

Wetlands within the area to be mined or disturbed were delineated and identified using the same criteria as for the generation facility site, contained in Section 3.8.2. Table 3.8.3-1 summarizes the approximate acreage and cover type of each wetland, as identified on Figure 3.8.2-1.

Table 3.8.3-1 Acreage of Delineated Wetlands on the Proposed Mine Site

Classification	Acres	Percent
Palustrine Forested	47.1	75
Palustrine Emergent	14.5	23
Lacustrine Emergent	1.5	2
TOTAL	63.1	100

The majority of wetlands in the area to be mined or disturbed are palustrine forested, with smaller acreages in palustrine emergent and only 1.5 acres as lacustrine emergent, which is the spring-fed pond in Section 27 on Figure 3.8.1-1. No scrub-shrub wetlands are located in the mine area.

3.8.4 Description of Wetlands in Utility Line Corridors

The wetlands in the two alternative 161-kV transmission line corridors proposed between the RHPP site and Sturgis, Mississippi, were identified using NWI maps, color infrared photography, and windshield surveys where road access was possible. Corridor A, the more southern route, is 12.3 miles long by 2000 ft wide; this route was surveyed for wetlands solely using photointerpretation of color infrared photography. A total of 185 acres of wetlands was identified, including forest/open water; forest/scrub-shrub; emergent; scrub-shrub/emergent; and aquatic bed wetland types (Figure 3.12.3-1). The largest areas of wetlands occur along an upper tributary of the Yockanookany River, which flows within the proposed transmission line corridor north of Ackerman. These particular areas are also largely associated with occurrence of the hydric soil mapping unit Guyton silt loam, 0 to 2% slope. Seventy-one acres of hydric soils occur in this corridor (USDA-SCS 1986). The portion of Corridor B (the more northern route) not shared with Corridor A extends from Sturgis to the abandoned ICG railroad line and west to the RHPP site boundary, and traverses primarily forested, rolling to hilly terrain. NWI maps indicate this portion of the corridor crosses one narrow palustrine scrub-shrub wetland and five palustrine forested wetlands. All of these wetlands are linear areas associated with streams/riparian zones. No hydric soils occur within this portion of the corridor. NWI maps indicate the proposed natural gas pipeline corridor crosses two palustrine forested wetlands between Highway 9 and the existing railroad line. There are also approximately 14 acres of hydric soils (Guyton silt loam, 0 to 2% slope) in the natural gas pipeline corridor. The proposed natural gas pipeline corridor overlaps transmission line Corridor A, and thus, the wetlands and hydric soils within the natural gas pipeline corridor also occur within transmission line Corridor A.

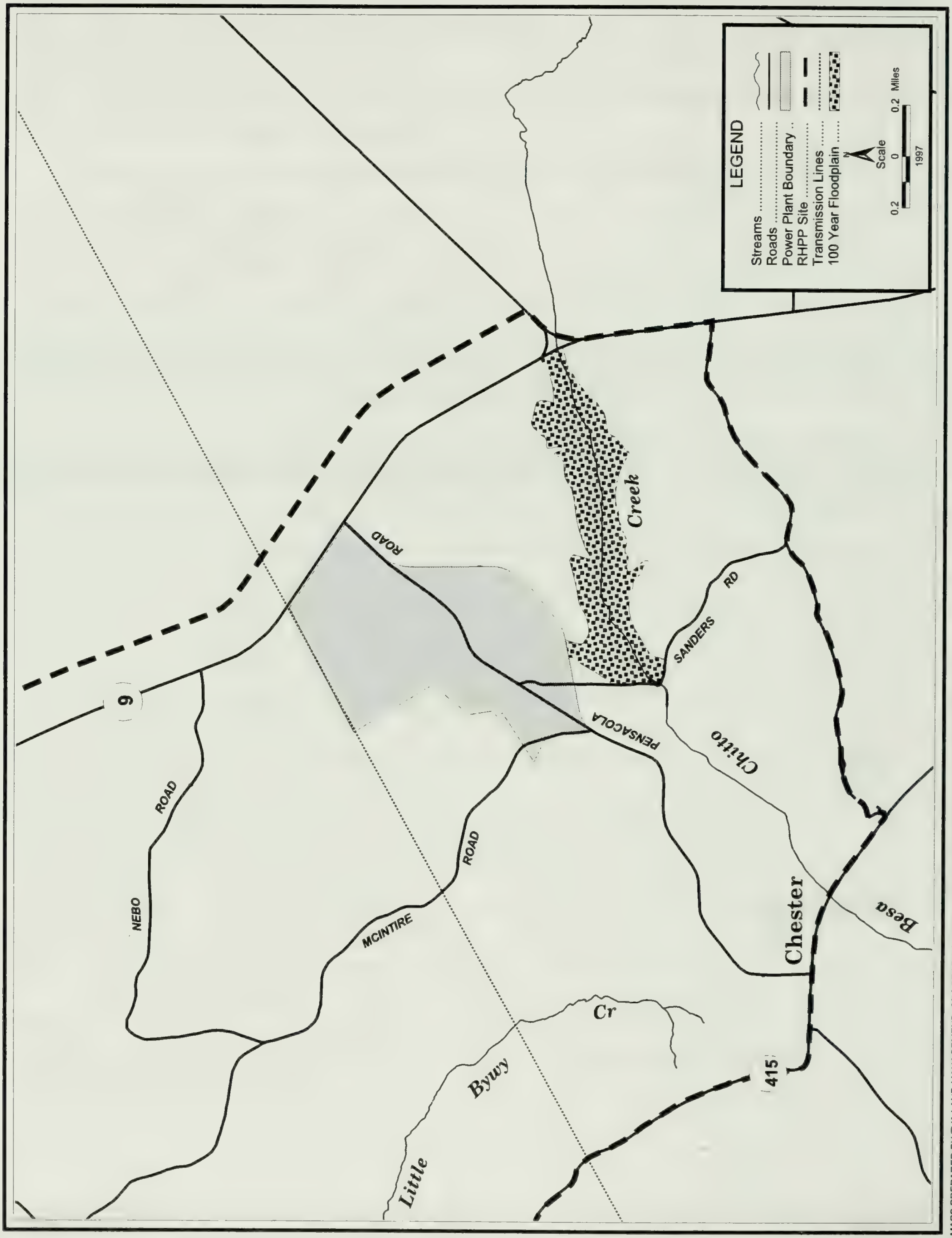
3.9 Floodplains

As described in Section 3.6, several permanent and intermittent streams occur within the Red Hills project area. No Flood Insurance Study has been published for Choctaw County, Mississippi, and, consequently, there is little available data on floods or mapped floodplains. The only existing flood data for project area streams is some approximate floodplain information developed by Neel-Schaffer, Inc., to evaluate potential flood impacts on the EcoPlex industrial park.

In order to evaluate the potential flood impacts at the proposed generation facility site, it was necessary to compute flood elevations for Besa Chitto Creek and a small tributary that is located to the southeast of the site. The flows for the 100- and 500-year flood events were developed using *Flood Characteristics of Mississippi Streams* (Landers and Wilson 1991). Cross sections were obtained from PCC's site map that has a scale of 1 in. to 1,000 ft with a contour interval of 5 ft. These cross sections and flows were used in the HEC-2 backwater computer model (USCOE 1990) to compute the flood elevations. Because of the nature of the data, the elevations must be considered as approximate.

The approximate 100-year floodplain in the vicinity of the generation facility site is the area lying below elevation 538.2 (Figure 3.9-1). The approximate 500-year (or critical action) floodplain is the area lying below elevation 538.6.

Figure 3.9-1 Approx. 100-yr floodplain.



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3.10 Terrestrial Ecology

3.10.1 Vegetation

Regional Vegetation

The project lies within the Oak-Pine Forest Region as described by Braun (1950). Although this is a region of oaks and pines, pines are ultimately replaced by deciduous species except on poor soils and dry sites. Common oaks are white, black, post, red, and southern red. Other common deciduous trees include mockernut and pignut hickories, sourwood, and sweetgum. The oak-pine region is distinguished from more interior regions by the abundance of loblolly pine and from more coastal regions by the scarcity of longleaf pine.

The Red Hills area occurs in a portion of the Oak-Pine Forest Region known as the North Central Plateau. The highest ridges were originally dominated by shortleaf pine and oak-hickory forests. More mesic slopes, deep ravines, and bottomland areas are also represented in the regional landscape. Aside from the lack of extensive, well-developed bottomland forests, the Red Hills site is generally representative of the North Central Plateau and the Oak-Pine Forest Region.

Historical Perspective

The vegetation of Choctaw County, including the RHPP area, has been subjected to intense changes in the last 150 years. Prior to that time few modifications had occurred. Hilgard (1860) gives an early description of the vegetation of the area. Based on Hilgard's description and other sources, the pre-European settlement landscape was composed of five forest types.

The highest and driest ridges were covered with shortleaf pine, blackjack oak, post oak, and sand hickory. Other slopes and lower ridges were covered with oak-hickory (post, white, southern red, and black oak, mockernut and pignut hickory), with other hardwood species such as sweetgum intermixed. This forest type was the most abundant type found in pre-settlement times. Some deep ravines and coves would have provided richer, moister conditions and would have been dominated by beech and tulip-trees (yellow-poplar). Slopes adjacent to these ravines would have had northern red oak and common shagbark hickory. Areas near large streams would have supported bottomland hardwood forests. Dominant bottomland species would have been cherrybark, water, and willow oak, swamp and bitternut hickory, sweetgum, tulip-tree, and American elm. A few bottomland forests with more acidic soils would also have sweetbay magnolia.

Today less than 25% of the area remains in forests whose species composition largely resembles pre-settlement forests. No virgin forests occur within the project area. Even in the least disturbed remaining forests, some changes have undoubtedly occurred through selective cutting and forest fire suppression. Modification of the landscape through clearing for row-crop agriculture has, until recently, been extensive. Many bottomland forests were lost through this process. Channelization of large streams

caused the drainage of adjacent land which previously had been periodically flooded. This land was thereby brought into agricultural use.

Forestry practices have changed the appearance of uplands as well. Many areas have been clear-cut and converted to pine plantations. In recent years much previously cultivated land has been planted in pine or has been abandoned and since reverted to pine-hardwood forests. Although the most common original pine species was shortleaf, today loblolly pine is the most abundant pine. Loblolly is the species planted in plantations and also establishes itself on abandoned agricultural lands to form pine-hardwood forests.

Local Vegetation

The vegetation of the RHPP area was studied during the growing season of 1997. Special emphasis was given to locating and inventorying the various plant communities located within the 9,300-acre study area. To evaluate the significance of the project area vegetation relative to similar nearby areas, an adjacent 8,000-acre tract was investigated using the same procedures. Forty plots (20 on the RHPP site and 20 on the adjacent area) of approximately 40 acres each were established and revisited from April to November. Plots were selected to encompass the range of habitats and communities present. Each plot was visited about six times, and each species encountered was identified. In addition, both tracts were repeatedly examined to identify additional species not found within the forty sample plots. Voucher specimens are housed in the herbarium of the Institute for Botanical Exploration at Mississippi State University.

The two tracts were found to be similar in vegetative composition. Both tracts contained the same major vegetation types in nearly identical proportions. The tracts were also similar in numbers and kinds of plant species, including common, rare, and exotic (non-native). However, as described below, the RHPP site does contain a few unusual plant communities.

Project Area Vegetation

Table 3.10.1-1 lists the major vegetation types in the 9,300-acre study area. Boundaries of the vegetation types were determined primarily by field observations, supplemented by topographic maps and aerial photographs. Vegetation types occupying less than one percent of the site are included within a broader classification. Thus, for example, the distinctive vegetation of rich ravines is included within mesic hardwoods. Similarly, wetlands are not treated as a separate class, but included within broader classes such as grasslands or bottomland hardwoods.

Table 3.10.1-1 Major Vegetation Types in the 9,300-Acre Study Area

Vegetation Type	Proportion of Area (%)
Mesic hardwoods	26
Pine-hardwoods	26
Pine plantation	11
Seedling/sapling following clearcut	10
Pastures/hayland	10
Bottomland hardwood	7
Thinned pine/hardwoods	6
Row crops	2
Lawn/residential	1

There are often no sharp demarcations between types. Thus, the seedling/sapling stage following recent clear-cuts is frequently planted with pine, creating an arbitrary distinction between seedling/sapling and pine plantations. Similarly, there is no marked differentiation between deciduous forests and pine-hardwoods. The percentage of pine versus hardwoods is a continuous range from 0 to 100%, and classifying a hardwood tract as either mesic hardwood or pine-hardwood is sometimes a matter of judgment.

The seedling/sapling vegetation type is most widespread in areas which have been recently clear-cut, and represents about one-tenth of the site. Areas representative of this type have had 90 to 100% of the larger woody vegetation removed. In some cases, any remaining trees have been killed to eliminate competition with the desired tree species. The initial vegetation to establish after a clear-cut depends upon several factors, including: (1) site quality; (2) the previous vegetation; and (3) the intensity of site preparation. Under optimal conditions, the number of species present may exceed 150 in the first year after harvest. Common species include grasses, especially panic grasses, sedges, rushes, wind-disseminated species such as fire-weed and broom-sedge, bird-disseminated species such as blackberry and poke-weed, and the original woody species present as stump sprouts or as released saplings. Following this initial flush in species diversity, the number of species present gradually declines as blackberries and hardwood and pine trees become dominant.

Pine plantations represent about one-tenth of the total area. They develop in two ways: (1) planting of abandoned fields or pastures or (2) planting of clear-cuts. Species diversity in pine plantations drops markedly a few years after planting as pine canopies close and shade out much of the ground cover. The species diversity later increases as hardwoods become established and some thinning of the pines occurs. However, under current management regimes, plant species diversity never returns to pre-plantation conditions.

Pastures/hayfields occupy about 10% of the area. They are primarily open areas, although they often have a few trees, especially near water courses. Improved pastures may have relatively few species and are often dominated by grasses such as Bahia grass, Dallis grass, fescue, and Bermuda grass mixed with

legumes such as clovers and medics. Other areas may be dominated by native herbaceous plants such as sedges, panic grasses, broom-sedge, rushes, and various forbs. Wetter areas may have additional species such as madders, eryngo, false-pimpernel, and redvine.

The vegetation types dominated by deciduous trees make up about one-third of the total area. These types are mesic hardwoods and bottomland hardwoods.

Mesic hardwoods occupy a variety of topographic sites. On the driest and highest ridges, this type consists of blackjack oak, post oak, sand hickory, and eastern red cedar. These sites grade into oak-hickory slopes with post oak, white oak, southern red oak, black oak, mockernut hickory, and pignut hickory with a mixture of other species such as sweetgum and winged elm. The steepest and richest slopes may have white oak, northern red oak, common shagbark hickory, and southern shagbark hickory. A distinct subtype, mesic beech ravines, occurs in the deepest ravines and is dominated by beech with some tulip-tree.

Bottomland hardwoods of non-acid soils have as dominant species cherrybark oak, water oak, willow oak, swamp hickory, bitternut hickory, sweet gum, tulip-tree, and American and winged elms. Those with more acid soils are dominated by red maple, water oak, willow oak, diamond-leaf oak, and sweetbay magnolia.

Pine-hardwoods represent about 26% of the total area. Less than 1% of the total area is dominated by a natural vegetation type of shortleaf pine with associated oaks and hickories. The remaining loblolly pine-hardwoods is almost exclusively the result of human activity either through abandonment of cultivated fields or pastures and subsequent plant succession or through forestry practices. Loblolly pine occurs naturally as scattered individuals in primarily hardwood swamps. The oaks and hickories associated with loblolly in the pine-hardwood stands are the same as those found in the hardwood types described above.

Lawn/residential vegetation is varied, but generally consists of planted ornamentals, some native pine and hardwood trees, and grassy lawns. At times, infrequently maintained areas may support a variety of native and introduced species.

Thinned pine/hardwoods are stands in which some of the trees have been selectively removed. These areas have a different understory species composition and provide a different habitat from the original forest. Because of the difficulty of determining the precise original composition, that is, which stands were predominantly pine and which were predominantly hardwoods, both types are included together.

The predominant row crops are corn and soybeans, although, historically, cotton was the dominant crop. These lands are annually cultivated and are occupied by the desired crop plant as well as assorted weeds. Row crops occur on about 2% of the project lands.

Uncommon Plant Communities

Although the general vegetational cover types in the project area are common and representative of the region, five uncommon plant communities occur (Table 3.10.1-2). None of these are considered to be of national significance. The spring-head seep may be of state significance. The cactus community is of state and regional significance.

Table 3.10.1-2 Uncommon Plant Communities	
Cactus community	1 site
Cane-brakes	2 sites
Mature hardwood forests	2 sites
Spring-head seep	1 site
Mesic beech ravines	1 site

A cactus community occurs in the northwestern corner of the RHPP site. This community is probably the driest habitat within the study area. It consists of over two acres of dry, rocky ridgetop and slope dominated by several thousand prickly pear cactus plants under an open overstory of blackjack oak, sand hickory, and Eastern red cedar. No other such area of this extent is known in Mississippi or adjacent states.

A small spring-head seep is immediately downslope of the cactus community. It has a distinctive and unique flora composed of sphagnum moss, royal fern, and cinnamon fern, diverse herbaceous species including sedges, cutgrass, and primrose-leaved violet, and woody species including pinxter azalea and buttonbush.

Cane-breaks are another distinctive vegetation type found on a very small part of the project area. They are dominated by river cane up to 33 ft tall. These are apparently the tallest individuals known in North America today (Platt and Brantley 1997).

Two small tracts of mature deciduous forests each have some canopy trees in excess of 100 years old. Their species composition is similar to what is assumed to occur at the climax stage of succession.

Two additional sites in the vicinity of the project area are on the Mississippi Natural Heritage Program registry of natural areas because of their significant plant communities. The Elmer E. Mabus Memorial Natural Area is a 40-acre undisturbed mixed pine-hardwood forest located about 1.25 miles east of Highway 9 and a short distance north of Ackerman. Its principle tree species are oaks, hickories, and loblolly pine.

The Mabus Family Natural Area is a relatively undisturbed xeric ridge forest located about two miles east of Highway 9 and a short distance north of Ackerman. It is dominated by white oak and shortleaf pine along the crest with an increase in importance of northern red oak and hickories on the slopes. The lower slopes and ravine bottom are dominated by tulip-tree, sweetgum, white ash, beech, and black gum. The diameters of canopy trees generally range from 10 to 24 in. and many hardwoods have crown

diameters of 20 to 40 ft. An Office of Surface Mining inventory for old growth forests determined this site had minimal recent disturbance.

Plant Species

The total of approximately 700 species (see Appendix C-16) in an area 1,700 acres (2.5 miles^2) sampled on the RHPP site. This total is comparable to other areas in Mississippi. MacDonald (1996) presented a comparison of the reported floras of counties or part-counties in Mississippi. These range from a total of 656 species in northern Tippah County (208 miles^2) to 1,281 species in Monroe County (769 miles^2). Major reasons for the higher species number in Monroe County are its location in two physiographic regions and the presence of a major stream.

Exotic species, with the exception of two species, make up a small portion of the plant cover. The exceptions are Japanese honeysuckle and kudzu which occasionally are abundant. Other introduced species are very local and associated with disturbance.

Vegetation of Generation Facility Site

Table 3.10.1-3 presents the major vegetation types on the proposed generation facility site. No uncommon plant communities are known from this 390-acre area.

Table 3.10.1-3 Major Vegetation Types on Proposed Generation Facility Site

Vegetation Type	Percentage
Pine plantation	48
Seedling/sapling	12
Row crops	12
Pasture/hayland	9
Pine-hardwoods	8
Open, unclassified	8
Mesic hardwoods	3

Vegetation of Mine Site

Table 3.10.1-4 presents the proportions of the major vegetation types on the proposed mine area. Approximately 85% of the area is currently forested. The remaining 15% is a mixture of pasture/hayland and seedling/saplings of recent clear-cuts. One mature hardwood forest, one mesic beech ravine, and one cane brake occurs in the area proposed for mine construction. One mature hardwood forest, the cactus community, and the spring-head seep area occur in the proposed mine area.

Table 3.10.1-4 Major Vegetation Types on Proposed Mine Site	
Vegetation Type	Percentage
Pine-hardwoods	35
Mesic hardwoods	30
Thinned pine-hardwoods	15
Seedling/saplings following clear-cuts	12
Pine plantation	4
Pasture/hayland	4

Vegetation of Transmission Line and Natural Gas Pipeline Corridors

Limited surveys of the vegetation of the proposed transmission line and natural gas pipeline corridors were conducted in September 1997. More thorough surveys will be carried out in the spring of 1998. The southern half of the proposed natural gas pipeline corridor, and the common portion of transmission line Corridors A and B, is dominated by pasture and scattered woodlands. The northern half of this corridor lies in an area of numerous clear-cuts and pine plantations. Pastures occupy a significantly smaller proportion of this section.

The remainder of transmission line Corridors A and B both contain mixes of hardwood forests, pine plantations, clear-cuts, and pasture. However, Corridor A contains significantly more clear-cuts and planted pine stands. Corridor B passes through more hardwoods and rich ravines than the southern route. The Elmer E. Mabus Memorial Natural Area and the Mabus Family Natural Area, both described above, occur within or near Corridor B. No other uncommon communities were observed along any of the proposed corridors.

3.10.2 Wildlife

The variety of plant communities located at the RHPP site provides several types of habitats important to terrestrial wildlife. These habitats include numerous woodlands, early successional habitats, and wetlands. Vertebrate wildlife species were surveyed in all major habitat types from spring through fall 1997. Surveying techniques included point-count surveys for breeding birds; live-trapping for small mammals; auditory and time-constrained surveys for amphibians and reptiles; and call, track, leaf nest, and pellet counts for game animals. These surveys identified 154 species of animals within the proposed area of the mine, generation facility, and EcoPlex (Appendix C-17); survey results are summarized in Table 3.10.2-1.

Table 3.10.2-1 Number of Species of Birds, Mammals, Amphibians, and Reptiles Found in Dominant Habitats on RHPP Lands (Jones 1997)

Habitat Type	% of Study Area	Birds	Mammals	Amphibians	Reptiles	Total Species
Woodlands	64.1	57	NA	8	12	77+
Early Succession*	31.8	63	NA	4	10	77+
Wetland	0.3	39	NA	16	9	64+

* Areas clear-cut within the past five years, old fields, and transmission line ROW.

Of all habitats surveyed, woodland habitats were most abundant; comprising about 64% (excluding clear-cuts) of the project area (Section 3.12.3). These habitats include hardwood-pine, upland hardwoods, bottomland hardwoods, unmanaged pine forests, and pine plantations. Hardwood-dominated habitats generally have higher animal diversity than pine types. Birds most frequently encountered during point-count surveys in woodland habitats included red-eyed vireo, northern cardinal, Acadian flycatcher, tufted titmouse, Carolina wren, wood thrush, and eastern towhee. Mammals commonly found in forested habitats include white-tailed deer, gray squirrel, eastern chipmunk, gray fox, hispid cotton rat, and southern short-tailed shrew. Common amphibians and reptiles included bird-voiced treefrog, three-lined salamander, Mississippi slimy salamander, American toad, three-toed box turtle, ground skink, green anole, and gray rat snake.

Early successional habitats make up 31.8% of the project area. These habitats include large clear-cuts (comprising 22.4% of the study area), pasture, grasslands, hay fields, and suburban areas. These habitats are primarily used by species of wildlife that favor habitats that have been recently disturbed. Birds that commonly forage or nest in these habitats include red-tailed hawk, turkey vulture, common crow, indigo bunting, eastern towhee, brown-headed cowbird, eastern meadowlark, northern bobwhite, yellow-breasted chat, eastern bluebird, and eastern wood-pewee. Resident mammals include eastern cottontail, red fox, coyote, eastern harvest mouse, hispid cotton rat, red bat, and big brown bat. Amphibians and reptiles that favor open or early successional habitats include chorus frogs, southern cricket frog, American toad, three-toed box turtle, fence lizards, southern black racer, and speckled kingsnake.

Wetland habitats important to wildlife include seepages, streams, creeks, and beaver ponds. Although these sites make up less than one percent of the total coverage type at the RHPP site (Table 3.10.2-1), almost one-third of all species encountered were found in these habitats. Wetlands are critical to many species of wildlife, such as wading birds, waterfowl, semiaquatic mammals, and amphibians, that depend on these sites for foraging and breeding areas. Birds most often found during surveys in wetland habitats include belted kingfisher, cattle egret, great blue heron, red-winged blackbird, common yellowthroat, and common crow. Resident mammals include beaver, muskrat, and raccoon. Many breeding populations of spring peeper, green treefrog, chorus frog, and southern cricket frog were heard during auditory surveys at wetland sites.

Most species observed during field visits to RHPP lands are locally and regionally abundant. However, some bird species commonly found on RHPP lands, may be experiencing population declines in recent years. Partners In Flight, an international program to conserve neotropical migrants, has assigned concern scores (measures of each species' degree of vulnerability) for many species of birds observed during surveys in the project area. Eleven species of birds identified during surveys are considered to have "very high" concern scores (Appendix C-17). Most of these species were found in bottomland hardwoods, riparian zones, and early successional habitats in the RHPP study area.

Other important habitats in the project area include three hardwood ravines dominated by American beech. These areas are important because many of the beech trees are hol'ow, providing important roosting sites for a variety of animals. They are also important habitats for some of the neotropical

migrant birds with high concern scores. Such stands of beech trees are rare in the project area due to the extensive silvicultural practices in the area. Additionally, seepages and small creeks, although rare on project lands, provide important breeding sites for many semi-aquatic species of wildlife. The single most important of these is the spring head seep described in Section 3.10.1 (Figure 3.10.2-1), which provides habitat for five species of salamanders.

Game Animal Populations

A variety of game animals occur on project lands. The mixture of forested and early successional habitats provides excellent habitat for white-tailed deer, wild turkey, mourning dove, northern bobwhite, gray and fox squirrels, eastern cottontail, and swamp rabbit. Three organized hunting clubs exist in the vicinity of project lands. Annual harvest information from hunting clubs participating in the Mississippi Department of Wildlife, Fisheries, and Parks Deer Management Assistance Program, indicate that 288 white-tailed deer were harvested by club members on private land in Choctaw County during 1995 and 1996 (Table 3.10.2-2). On RHPP lands, track counts indicate that white-tailed deer populations may be as high as one deer per thirty acres. During the 1996 to 1997 hunting season, about 100 deer were harvested on project area lands leased by hunt clubs.

Table 3.10.2-2 Summary of Deer Harvest Data for Hunting Clubs Assisted by Mississippi Department of Wildlife, Fisheries, and Parks Deer Management Assistance Program in Choctaw County, Mississippi (1991-1996)

	91-92	92-93	93-94	94-95	95-96	Average
Acres	17,708	19,461	11,947	12,658	17,760	
Total # of Deer	220	206	238	200	288	
Bucks	129	102	108	93	113	
Does	91	104	130	107	175	
Deer/100 Acres	1.25	1.19	2.00	1.59	1.61	1.53

Hunters harvested about ten wild turkeys during the 1996 to 1997 spring season. Track count surveys for turkey along unimproved roads in the study area provided a conservative estimate of five turkeys per mile. Turkeys were most abundant in the southeastern portion of RHPP lands. No harvest information is available for small game. Surveys conducted during 1996 to 1997 found populations of northern bobwhite, mourning dove, gray squirrel, fox squirrel, eastern cottontail rabbit, and swamp rabbit. Call-count surveys indicate that bobwhite are most abundant in clear-cuts and transmission line ROW, and mourning doves are most abundant on the edge of forested habitats (Table 3.10.2-3). Leaf nest counts indicate that squirrels were more abundant in hardwood stands than pine stands. Rabbits were most abundant in wetland and old field habitats.

Table 3.10.2-3 Average Number of Male Northern Bobwhite and Mourning Dove Encountered During Three Call-Count Survey Periods in Three Habitat Types on RHPP Lands in May 1997

	Clear-cut (<5 years) N=5	Transmission line ROW N=3	Forest N=5
Northern Bobwhite	11	10	3
Mourning Dove	4	5	8

3.11 Threatened or Endangered Species

Species of federal concern include those listed as threatened or endangered by the U.S. Fish and Wildlife Service under the authority of the Endangered Species Act of 1973, as amended, species proposed for such listing, and candidate species for such listing. Plant and animal species of State concern are those identified on the special plant and special animal lists of the Mississippi Natural Heritage Program (1997a, 1997b). Based on reviews of data bases maintained by the Mississippi Heritage Program and the TVA Regional Heritage Project, no federally- or state-listed species are historically known to occur in the Red Hills project area. In response to the Notice of Intent to prepare this DEIS (Appendix A-1), the U.S. Fish and Wildlife Service indicated that no populations of federally-listed species were known to occur in the project area (letter in Appendix C-18).

A review of the data bases of the Mississippi Natural Heritage Program (1997) and the TVA Regional Heritage Project indicated that 103 species of listed plants and animals were known from Choctaw or surrounding counties and potentially could occur within the project area. Seventy-six plant species, seven terrestrial animal species, and twenty aquatic animal species were identified as possibly being present. These species, listed in Appendix C-19 (plants), and in Tables 3.11.2-1 (terrestrial animals) and 3.11.3-1 (aquatic animals), were the targets of intensive field surveys carried out in 1996 and 1997. The results of these surveys are described below.

3.11.1 Plants

Many of the 76 potentially occurring plant species occupy habitats such as prairies or highly calcareous woodlands which do not occur in the project area. These plant species are, therefore, unlikely to be found in the Red Hills area. This is the case with Price's potato-bean, the only potentially occurring federally-listed plant species.

No federally-listed plant species were found on the RHPP site. Seven species of state-listed plants were found in the project area; they are listed in Table 3.11.1-1. One species (ginseng) is located on the proposed generation facility site. One population of white turtlehead is located on the proposed Ecoplex. One population of turkscap lily and one population of bladdernut are located in an area east of Highway 9 that would not be involved in the proposed activity. The remaining populations all occur within the area of the proposed lignite mine.

Table 3.11.1-1 State-Listed Plant Species			
Common Name	Scientific Name	Protective Status*	Number of Sites
Swamp hickory	*Carya leiodermis*	S2S3	2
White turtlehead	*Chelone glabra*	S3	2
Turkscap lily	*Lilium superbum*	S3S4	6
Ginseng	*Panax quinquefolius*	S3	1
Odorless mock-orange	*Philadelphus inodorus*	S2	1
Ragged fringed orchid	*Platanthera lacera*	S1S2	1
Bladdernut	*Staphylea trifolia*	S3	2

*Rather than identifying categories of rarity, such as threatened or endangered, the state of Mississippi categorizes listed rare plants according to a nationally-used status system of S1 to S5. Within this system, S1 is critically imperiled and S5 is common. Categories relevant to Red Hills are:

S1 Critically imperiled in Mississippi because of extreme rarity.
S2 Imperiled in Mississippi because of rarity or because of some factor making it vulnerable to extirpation.
S3 Rare and uncommon in Mississippi.
S4 Apparently secure in Mississippi.
Combined statuses, such as S2S3, indicate a degree of rarity between the principle categories.

<u>Swamp hickory</u> – Swamp hickory is a tree which reaches 25 meters in height and has smooth to furrowed bark. It occurs in moist sites, chiefly in bottomland hardwoods along creeks, and is found from northern Mississippi through Louisiana to Arkansas and southeast Texas.

<u>White turtlehead</u> – White turtlehead is an herbaceous, fall flowering perennial up to 1.5 m tall, with showy white to pinkish flowers. It occurs in very moist woodlands, seepages, bogs, and streambanks, and ranges from Newfoundland west to Minnesota, and south to Georgia and Mississippi.

<u>Turkscap lily</u> – Turkscap lily is a tall, summer flowering perennial, growing one to three meters tall, with several large, showy purple-spotted orange flowers. It occurs in a variety of wet or moist wooded or open habitats, but typically flowers only in sunny conditions. It ranges from New Brunswick west to Minnesota, and south to Florida and Missouri.

<u>Ginseng</u> – Ginseng is a herbaceous perennial, up to 60 cm tall, with one to four compound leaves and a fruiting cluster at the end of a leafless stalk. It occurs in rich woods, and ranges from Quebec west to Minnesota, and south to Georgia and Oklahoma.

<u>Odorless mock-orange</u> – Odorless mock-orange is a leggy, late spring flowering shrub with large white flowers. It occurs in moist, rich woods and wooded bluffs. It is primarily a species of the southern Appalachians, ranging from Pennsylvania south to Georgia and west to Alabama and Mississippi.

<u>Ragged fringed orchid</u> – Ragged fringed orchid is a late spring or early summer flowering perennial, growing up to 70 cm, with a spike of yellowish-green or whitish-green flowers. It occurs in open, wet, sunny swamps; wet pine-oak woods; or moist roadsides, and ranges from Newfoundland west to Manitoba, and south to South Carolina, northern Mississippi, and northeastern Oklahoma.

<u>Bladdernut</u> – Bladdernut is a shrub or small tree with opposite compound leaves and with distinctive

papery, inflated bladderlike fruits. It occurs in rich woods, bluffs, and ravines, and ranges from Quebec west to Minnesota, and south to Florida and Oklahoma.

3.11.2 Terrestrial Animals

Records provided by the Mississippi Natural Heritage Program, the TVA Regional Natural Heritage Program, and the U.S. Fish and Wildlife Service indicated that seven species of rare terrestrial animals have been reported from north-central Mississippi and that suitable habitat for these species may exist in the project area (Table 3.11.2-1).

During field surveys in 1997, special emphasis was placed on locating and identifying populations of federally- and state-listed terrestrial animals and any rare habitats important to wildlife at the project site. No state- or federally-listed species were identified. The availability of habitat for the seven species indicated in Table 3.11.2-1 is discussed below.

Table 3.11.2-1 Federally- and State-Listed Terrestrial Animals of Concern Potentially Occurring on RHPP Lands

Common Name	Scientific Name	Protective Status*	Availability of Habitat
Red-cockaded woodpecker	*Picoides borealis*	Federal: Endangered State: Endangered, S1S2	None
Bald eagle	*Haliaeetus leucocephalus*	Federal Threatened State: Endangered, S1	None
American alligator	*Alligator mississippiensis*	Federal: Threatened State: S4	Limited
Bachman's sparrow	*Aimophilus aestivalis*	State: S3S2	Yes
Mole kingsnake	*Lampropeltis calligaster rhombomaculata*	State: S4	Yes
Webster's salamander	*Plethodon websteri*	State: S3	Yes
Alligator snapping turtle	*Macroclemys temminckii*	State: S3	Limited

*State status codes beginning with "S" indicate status as defined in footnote to Table 3.11.1-1.

Red-cockaded woodpecker – The red-cockaded woodpecker is endangered because of its dependence on extensive mature to old-growth pine forests with an open mid-story, a habitat which has become very rare. Most records in Mississippi are from the southern portions of the state. However, red-cockaded woodpeckers have been reported north and southwest of the project site. The closest records of nesting red-cockaded woodpeckers are from Noxubee National Wildlife Refuge (NNWR) in Winston and Noxubee Counties. No pine stands suitable for red-cockaded woodpeckers occur on the RHPP site.

Bald eagle – Bald eagles were originally listed as endangered because of severe declines due mostly to DDT poisoning. During the 1980s and 1990s, its population in much of North America greatly increased, and it is presently listed as threatened. In north central Mississippi, most bald eagles occur on the NNWR and along from the Tennessee-Tombigbee Waterway. Bald eagles typically nest near or adjacent to large rivers or reservoirs where they forage. No bald eagles have been reported from the project area and no suitable habitat exists on RHPP lands.

American alligator – Historically, alligators could be found throughout the southern two-thirds of Mississippi. Now most are restricted to the larger river systems and the Gulf Coast. American alligators have been reported 60 miles south of the project site at NNWR. Potential habitat is very limited on the RHPP site because of the absence of large river systems and because project area wetlands are small and few in number. None were encountered during 1997 field surveys.

Bachman's sparrow – The Bachman's sparrow probably once occurred in the project area, however it has not been reported in Choctaw County in recent years. This bird is more abundant in longleaf pine-grassland ecotypes in the Lower Coastal Plain. No birds were located during 1997 field surveys, although some of the young pine plantations in the study area may provide suitable habitat for this species.

Mole kingsnake – This secretive, mostly subterranean snake is typically found in upland pine habitats having loose, sandy, slightly acidic soils. During surveys for reptiles during 1997, a prairie kingsnake (*Lampropeltis calligaster calligaster*) was observed. The prairie and mole kingsnake have similar habitat requirements, and therefore, suitable habitat for the mole kingsnake may occur in the RHPP study area.

Webster's salamander – Webster's salamanders are mostly found in eastern Alabama and western Georgia. However, a few isolated populations have been found in Winston and Hinds Counties in Mississippi. This small salamander is restricted to moist rocky outcrops in hardwood forests. Although this habitat exists on project lands in limited amounts, no Webster's salamanders were found during 1997 surveys.

Alligator snapping turtle – Alligator snapping turtles are typically found in large rivers or reservoirs. There are two large wetland complexes located on project lands. However, because no large rivers are located near project lands, habitat is considered limited.

3.11.3 Aquatic Animals

Information available from a variety of sources including records provided by the Mississippi Natural Heritage Program, the TVA Regional Natural Heritage Program, and the U.S. Fish and Wildlife Service indicated that 20 threatened, endangered, or rare species of aquatic animals might occur in parts of the Big Black, Yockanookany, and Noxubee River systems within or draining the project area. These species are listed in Table 3.11.3-1. During the fish, general invertebrate, and mussel surveys conducted for this project in 1996 and 1997, special attention was given to searching suitable habitats for specimens of listed or rare species. The only aquatic species encountered during this survey effort that is being monitóred by the Mississippi Heritage Natural Program was the chestnut lamprey (*Ichtyhomyzon castaneus*). General and project area information about all of these species is discussed below.

Table 3.11.3-1 Federally- and State-Listed Aquatic Species That Could Occur in Streams Near the RHPP Lands

Common Name	Scientific Name	Protective Status*	Availability of Habitat
Shultispear crayfish	*Procambarus lylei*	State: S2	Limited

Table 3.11.3-1 Federally- and State-Listed Aquatic Species That Could Occur in Streams Near the RHPP Lands			
Common Name	Scientific Name	Protective Status*	Availability of Habitat
Penitent mussel	*Epioblasma penita*	State and Federal: Endangered	Limited
Fine-lined pocketbook	*Lampsilis altilis*	Federal Threatened	Limited
Orange-nacre mucket	*Lampsilis perovalis*	State: Endangered Federal: Threatened	Limited
Alabama moccasinshell	*Medionidus acutissimus*	State: Endangered Federal: Threatened	Limited
Southern clubshell	*Pleurobama decism*	State and Federal: Endangered	Limited
Ovate clubshell	*Pleurobema perovatum*	State and Federal: Endangered	Limited
Chestnut lamprey	*Ichthyomyzon castaneus*	State: S4	Yes
Alabama sturgeon	*Scaphrhynchus suttkusi*	State: Endangered	None
Paddlefish	*Polyodon spathula*	State: S4	None
Alabama shiner	*Cyprinella callistia*	State: S3	None
Silverside shiner	*Notropis candidus*	State: S3	None
Fluvial shiner	*Notropis edwardraneyi*	State: S3	None
Blue sucker	*Cycleptus elongatus*	State: S3	None
Frecklebelly madtom	*Noturus munitus*	State: Endangered	None
Northern madtom	*Noturus stigmosus*	State: S3	Limited
Western sand darter	*Ammocrypta clara*	State: S1	Limited
Crystal darter	*Crystallaria asprella*	State: Endangered	None
Backwater darter	*Etheostoma zoniferum*	State: S2	Limited
Freckled darter	*Percina lenticula*	State: S2	Limited

*State status codes beginning with “S” indicate status as defined in footnote to Table 3.11.1-1.

Shultispear crayfish - This is one of several Mississippi crayfishes with limited ranges which have been found in the northern part of the state. None of the seven crayfish taxa identified from the general invertebrate sampling in the project area (see Section 3.7) is on the federal or state endangered or rare list.

Mussels - All six of the freshwater mussel species included in Table 3.11.3-1 are threatened or endangered species which could occur in smaller tributaries of the Tombigbee River system. No endangered or rare mussels are known to occur in the Big Black River system or in smaller streams within the Pearl River system (including the upper Yockanookany River basin). Mussel collections were made some distance downstream from the project area in all three river systems in an attempt to locate protected species if they were present (see Section 3.7). No threatened, endangered, or state-designated rare mussel species were found in any of these streams.

Big river fishes - Similar to the mussels, eight fishes included in Table 3.11.3-1 (Alabama sturgeon, paddlefish, Alabama shiner, silverside shiner, fluvial shiner, blue sucker, frecklebelly madtom, and

crystal darter) are rare or endangered species which usually are found in large creeks and rivers but, occasionally, could occur in smaller streams such as those not far downstream from the project area. The Alabama sturgeon, Alabama shiner, silverside shiner, fluvial shiner, and frecklebelly madtom are restricted to the Mobile River system, while the paddlefish, blue sucker, and crystal darter have much wider ranges in the Mississippi and Mobile River systems. No representatives of these species were found during either the spring or summer fish collections.

Chestnut lamprey - This relatively widespread Mississippi and Mobile River system lamprey usually occurs in larger streams and rivers. One specimen of this rare species (in Mississippi) was found at the most downstream sampling site on Big Bywy Ditch during the 1997 survey.

Northern madtom - As its name implies, the northern madtom typically is found in streams within the midwestern part of the Mississippi River system (western Tennessee to Pennsylvania) and in the western part of the Lake Erie drainage basin. In Mississippi, a few specimens have been found as far south as the lower Big Black River. This rare fish in Mississippi was not encountered during the 1997 fish sampling.

Western sand darter - The distribution of this darter occurs primarily on the west side of the Mississippi River, from Texas to Wisconsin. Isolated populations are known from Kentucky, northeast Tennessee, and in the Big Black River system. No specimens of this fish were found during the 1997 sampling for this project.

Backwater darter - The backwater darter is restricted to the Alabama and Tombigbee river systems below the Fall Line. It occurs in pools of small streams with sand and silt substrates. In spite of the presence of appropriate habitat, this species was not encountered during the 1997 sampling in Sand Creek and its tributaries.

Freckled darter - This large, rare darter is restricted to the Pearl, Pascagoula, and Mobile River systems. It apparently occurs in rapids within medium and large rivers. No specimens of this species were found during the sampling on Sand Creek for this project.

3.12 Land Use

The primary land use (86%) in Choctaw County in 1994 was forestry (Hartsell and London 1995). Based on the latest US Census of Agriculture (Bureau of the Census 1993a), cropland and pasture/hayland represent other significant classes of land use in this primarily rural county. This section discusses: (1) agricultural, forestry, and industrial/commercial/residential land uses and trends in Choctaw County; and (2) present (premining) land use/land cover in the RHPP area and the proposed new utility corridors. The socioeconomic aspects of land use are addressed in Section 3.14.

3.12.1 Agricultural and Forestry Production in Choctaw County

As shown in Appendix C-20, land in farms in 1992 totaled about 42,712 acres, or 16% of the 268,242-acre Choctaw County total land area. According to the 1992 US Census of Agriculture, cropland

represented 7.1% and pasture/hayland about 8.7% of the land use in the county. Cotton, corn, and soybeans were the most commonly grown row crops. The market value of agricultural products sold in Choctaw County in 1992 was about $5,327,000 (Appendix C-20). About $4,496,000 of this was derived from livestock and poultry, and $831,000 from crops sold.

Within the ten-year period of 1982 to 1992, the number of active farms in Choctaw County decreased from 332 to 195. During this period, there was a 44% decrease in total land in farms, a 52% decrease in acres of cropland, and a 40% decrease in pasture/hayland acreage (Appendix C-20). Although the total market value of agricultural products sold decreased only slightly, the proportion of market value from crops versus market value from livestock and poultry decreased significantly during this ten-year period. Decreasing land use in farming enterprises, especially row crops, appears to be a county-wide trend.

In contrast to present trends in agricultural crops, forest statistics indicate a predominant and increasing forest land use in Choctaw County (Donner and Hines 1987; Hartsell and London 1995). In 1994, about 86% (230,100 acres) of the county was occupied by forest land. Forest land ownership in Choctaw County in 1994 was as follows: individual ownership (59%), forest industry (25%), farmer (10%), and national forest (6%). Recent forest type acreages identified for the county were oak-hickory (42%), oak-pine (23%), planted pine (16%), natural pine (14%), and oak-gum (5%) (Hartsell and London 1995). The forest stand-size class acreage distribution reported in that study was as follows: sawtimber (39%), sapling-seedling (36%), and pole-timber (25%). According to the July 1996 Regional Economic Information System (REIS) computer database (Bureau of Economic Analysis 1996), lumber and wood products generated $11,398,000 of personal income within Choctaw County in 1994.

3.12.2 Industrial, Commercial, and Residential Land Use

Land utilized for industrial, commercial, and residential purposes in Choctaw County occurs largely within the three incorporated Towns of Ackerman, Weir, and French Camp. A total of about 4.4 $miles^2$ (2,816 acres) was occupied by these three urban areas in 1990 (Bureau of Census 1993b). Other less concentrated areas of industrial, commercial, and residential land occur as small parcels scattered throughout the county. A primarily rural county, the total population of Choctaw County in 1996 was about 9,000 (Bureau of Economic Analysis 1996). Total nonfarm earnings of about $46,013,000 in 1994 were associated primarily with durable and nondurable manufacturing goods, government, construction, services, wholesale/retail, and transportation/public utilities.

3.12.3 Land Use/Land Cover - Study Area

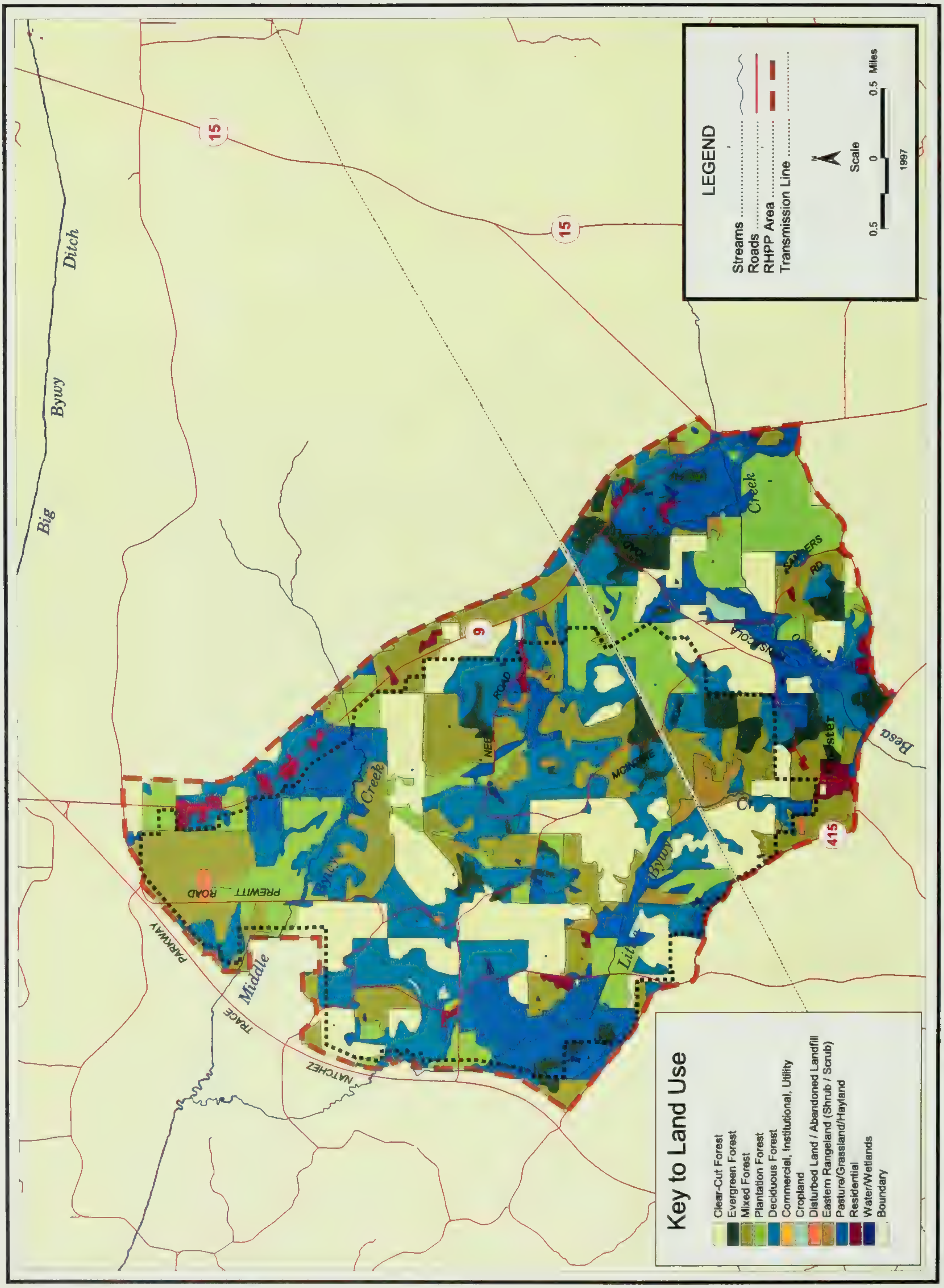
Based on photointerpretations of October 1996 aerial photography and field inspections during spring and summer 1997, eight primary land use/land cover classes were identified for the 9,300-acre study area. These are listed in Table 3.12.3-1 and illustrated in Figure 3.12.3-1.

Table 3.12.3-1 Land Use in the Red Hills Power Project Area

Land Use/Land Cover Classification	Acres	Percent of Project Area
Abandoned Landfill/Disturbed Land	18	0.2
Commercial, Institutional, Utility	63	0.7
Cropland	28	0.3
Forestry	7,598	81.8
(Clear-cut Forest)	(1,014)	(10.9)
(Deciduous Forest)	(2,239)	(24.1)
(Evergreen Forest)	(1,224)	(13.2)
(Mixed Forest)	(1,238)	(13.3)
(Plantation Forest)	(1,883)	(20.3)
Idle Land	149	1.6
Pasture/Grassland/Hayland	1,221	13.1
Residential	176	1.9
Water/Wetlands	37	0.4
Totals	9,289	100.0

Based on photointerpretations of October 1996 aerial photography and spring-summer 1997 field inspections.

Figure 3.12.3-1 Land use/land cover.



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

The land use classes include the following:

Forestry

Occupying about 82% (7,598 acres) of the study area, forestry consists of land used or managed for the long-term production of wood or wood-derived products. The level of management of lands used for forestry varies greatly within the project area. Based on the level of management and forest type, five major categories of forest lands were identified within the project area: clear-cut forest, deciduous (i.e., hardwood) forest, evergreen (i.e., pine) forest, mixed forest, and plantations. During the summer of 1997, clear-cut forest represented about 11% (1,014 acres) of the study area.

Deciduous forest consists of mostly unmanaged forest land (about 24% of the project area) in oak, sweet gum, yellow poplar, hickory, and other hardwood species. Approximately one-half of the 2,239 acres of this type is in sawtimber. Evergreen forest occurs on about 13% of the area (1,224 acres) and consists mainly of solid stands of natural loblolly and shortleaf pine. Mixed forest consists of mostly unmanaged mixed stands of hardwoods and pines largely in sawtimber, but of mixed age. Mixed forest occurs on about 13% of the project area. Managed plantations are primarily planted loblolly pine, largely of poletimber size, with some seedling to sapling stock. Forest plantations occupy about 20% of the project land area.

Pasture/Grassland/Hayland

This land use classification occurs on about 1,221 acres (approximately 13%) of the project area. It includes managed land used primarily for the long-term production of adapted, domesticated forage plants that are grazed by livestock or occasionally cut for hay. It also contains some minimally managed grassland of indigenous vegetation that is used for grazing, browsing, or that is occasionally cut for hay.

Cropland

A field inspection of the project area in June 1997 revealed that only about 28 acres of the project area was used for cropland. Cropland is defined as land used for the production of adapted crops for harvest, and includes row crops, small grain crops, nursery crops, truck crops, and orchard crops. Corn, home garden crops, orchards, and wildlife food plots comprise the several small land parcels identified as cropland.

Idle Land

About 149 acres of the project area was classified as idle land. This is unmanaged open land that has been allowed to return naturally to an undeveloped state or has been allowed to return to forest through natural succession. It is commonly vegetated by miscellaneous herbs, shrubs, and volunteer tree seedlings. This land category is also referred to as eastern rangeland, and it may or may not be used for browsing.

Abandoned Landfill/Disturbed Land

This land use class consists of one abandoned garbage landfill site (18 acres) and a few small (about one acre) shallow sand, gravel, and borrow pits. Most of these pits have been abandoned. In the published Choctaw County soil survey (USDA SCS 1986) these pits are identified by the symbol "Pf", Pits-Udorthents complex. The total acreage of abandoned landfill/disturbed land is less than ten acres.

Commercial/Institutional/Utility

This land use class occupies about 63 acres (less than 1%) of the project area. This use consists primarily of churches, cemeteries, an existing power transmission ROW, and a small horse-training facility. There are three commercial buildings within the EIS boundary area. The existing TVA 500-kV transmission line ROW occupies about 57 acres. Four acres are occupied by four churches, and two acres by cemeteries. Land occupied by cultural and historical resources is described in more detail in Section 3.13.

Residential

About 176 acres (less than 2%) of the project area is classed as residential. This consists of single-family housing including mobile homes, outbuildings, small garden plots, and other adjacent open space. Within the EIS boundary area, there are 134 houses, 32 mobile homes, 55 barns, and 24 sheds and storage buildings. Most of the land classified as residential occurs in the communities of Chester and Reform, and along Highways 9 and 25 and McMullen Road.

Water/Wetland

This land use class consists of land used for storing water for beneficial uses, including farm stock ponds, fish ponds, and wetland areas. These wetland areas generally occur adjacent to several small farm ponds and along streams. About 68 acres of study area are wetlands. A detailed description of wetlands has been provided in Section 3.8.

3.12.4 Land Use/Land Cover - Utility Corridors

Corridor A - Land use/land cover was determined for the proposed 161-kV transmission corridor ("South" alternative) extending from Sturgis, Mississippi, west to Ackerman, and north to the RHGF. Based on interpretations of color infrared aerial photography obtained on April 7, 1997, acreages were determined for eight land use/land cover classes within the 2,000-ft wide land corridor (Table 3.12.4-1). Within the proposed transmission line corridor, about 78% is forest and another 159 acres has been recently clear-cut. Cropland and pasture/hayland occur on about 11% of the land corridor area. Most of this occurs north of Ackerman along the abandoned railroad corridor. This area is occupied largely by nearly level bottomlands of the Oaklimeter series, a prime farmland soil.

Table 3.12.4-1 Land Use in Proposed Transmission Line Corridor A		
Land Use/Land Cover Classification	Acres	Percent of Project Area
Commercial/Service/Institutional	10.8	0.4
Cropland/Pasture	337.0	11.3
Disturbed Land/Stripmines/Borrows	44.6	1.5
Electric ROW/Substations	43.1	1.4
Forestland/Recent Clear-Cut	2,335.2	78.4
Open Water	9.7	0.3
Residential	10.9	0.4
Wetlands	185.4	6.2
Totals	2,976.7	100.0

* Based on photointerpretation of April 1997 color infrared aerial photography.

Palustrine wetlands occur on about 6.2% of the transmission corridor, as identified from photointerpretation of the recent color infrared aerial photography. Several subcategories of Palustrine wetlands were identified including forest/open water, forest/scrub-shrub, emergent, scrub-shrub/emergent, and aquatic bed. The largest areas of wetlands occur along an upper tributary of the Yockanookany River which flows within the proposed transmission line corridor north of Ackerman. A more detailed characterization of the wetlands in the proposed transmission corridor has been described in Section 3.8.

Disturbed land and land identified as surface mines, quarries, and borrows total about 45 acres. This minor land use category occurs primarily in association with shallow sand, gravel, and soil borrow pits, and land disturbed for commercial or industrial uses. Another 10.8 acres of the proposed transmission corridor occurs as a commercial/service/institutional land use category. This category includes three cemeteries, small parcels of commercial and industrial land in the northern outskirts of Ackerman along Highway 15, and a small area used for transportation/communication.

An existing 69-kV electric transmission ROW exists within the proposed new transmission corridor between Ackerman and Sturgis. There are also two existing 69-kV electric substations, one located near Sturgis and one near Ackerman. Land occupied by these existing electric transmission facilities totals about 43 acres (1.4%) of the proposed transmission corridor area.

The land within the 2,000-ft wide corridor is only sparsely used for residential purposes. A total of about 11 acres is identified as residential land. This consists of single-family housing, mobile homes, secondary buildings, and adjacent residential use open space. About 40 residential, 27 secondary, and 4 mobile home structures have been identified within the corridor from photointerpretation of April 1997 color infrared photography.

About ten acres of open water occur within the proposed electric transmission corridor. This consists of several small farm ponds, and represents about 0.3% of the total area within the corridor.

Land use within the proposed new natural gas pipeline corridor proposed between the EcoPlex site and the existing interstate pipeline north of Ackerman consists of approximately 75% forest, 15% cropland/pasture, and 10% wetlands. The forests consist of a mixture of hardwoods and pine, with a considerable acreage of recent clear-cut forest. This proposed natural gas pipeline corridor occurs within a portion of the proposed electric transmission corridor extending north from Ackerman to the RHGF.

Corridor B - The proposed route for Corridor B is described in Section 2.2.3 and illustrated in Figure 2.2.3-1. The ROW for this route would cross hilly terrain with narrow creek bottoms. Generally, this terrain is not especially suited for row crop agriculture, thus the predominant land use is forestry. Transmission line ROWs required would be about 169 acres, 122 acres of which are currently forested.

3.12.5 Forestry

The project area is considered to be in the Oak-Pine Forest Region (Gulf Slope Section) (Braun 1950). A description of typical forest tree species and their habitats is provided in Section 3.10.1. The region's forests have been harvested repeatedly since the area was first settled in the early 1800s. Because of this extensive harvesting to clear land for agriculture and to provide forest products (i.e., lumber and pulpwood), no virgin forests exist in the area. Although there are a few small areas containing larger, older trees, virtually all forest land in the region is at least second growth.

Because local markets for standing timber have remained relatively strong over the long term, timber sales by private landowners are relatively frequent. Both clear-cutting and selective-cutting have been used extensively in the area to harvest timber. Clear-cutting involves removal of the merchantable timber in a stand. Selective-cutting in the form of "high-grading," that is, removal of the best and most valuable trees while leaving the undesirable trees, has been a common harvesting practice in the area.

Typically, once harvested, hardwood forest land has been allowed to regenerate naturally. However, conversion of cut-over hardwood forest land to pine plantations is common. Although there are some natural pine stands, most large pine acreage is the result of conversion of cut-over forest land or old agricultural or pasture land to pine plantations. The plantation pine of choice is loblolly pine due to the persistent demand for pine lumber and pulpwood for paper manufacture. There is some demand for hardwood pulpwood. High quality hardwood sawtimber brings consistently high prices; however, supplies may be declining. A description of Choctaw County forest statistics is provided in Section 3.12.1. General forest characteristics of the RHPP site are provided in Section 3.12.3 and in Table 3.12.3-1.

3.12.5.1 Study Area

In order to obtain a detailed estimate of forest resources in the proposed study area, a field inventory was initiated in the summer of 1997. This study focused on that part of the study area (see Figure 2.5-1) exclusive of the 628-acre area located east of State Route 9. The area east of Route 9 was excluded because those forest resources would not disturbed. Forest stands greater than five acres were delineated

stereoscopically from 1:12,000 scale color infrared aerial photographs. Individual stands were assigned a preliminary forest type code consisting of a forest species class, a forest size class and forest density. Ground truth was used to verify initial determinations. The five species classes included: pine, hardwood, pine/hardwood, hardwood/pine, and clear-cut. Size classes were: seedling/sapling, pulpwood (small pole), small sawtimber, and sawtimber. Stocking was used to determine the three density classes: sparse, normal, and dense. Acreages by forest species group and size class are summarized in Table 3.12.5.1-1.

Table 3.12.5.1-1 Forest Acreages by Major Forest Type - Red Hills Study Area

	Acres			
Size Class	Pines	Hardwoods	Mixed Pine-Hardwoods*	Cutover
seedling/sapling	1,650.5	109.7	141.8	
pulpwood	462.7	1,048.8	425.9	
small sawtimber	178.4		59.2	
large sawtimber	815.3	1,080.5	614.0	
Totals	3,106.9	2,239.0	1,240.9	1,013.8

*Includes pine/hardwood and hardwood/pine classes.

A current inventory of timber volumes, growth rates, and values was obtained from data collected in a systematic, fixed-radius, line plot inventory. Data collected included tree species, diameter, height, and numbers of trees present. Radial growth data were collected from increment core readings. Timber volumes by species and by product classes (i.e., seedling/saplings, pulpwood, small pine sawtimber, and pine or hardwood sawtimber) were determined for the project area (exclusive of the area east of State Route 9). Within this area, similar determinations were made for the mine area (i.e., the area that would be excavated), along with associated areas to be used for support activities; the generation facility site, including the ash management unit; and the EcoPlex site.

Data from the field inventory were used to estimate standing timber value for the proposed mine area based on timber prices quoted in the May/June 1997 *Mississippi Timber Price Report* (Mississippi State University Cooperative Extension Service 1997). Within the project area, total timber resources are estimated to have a current value of approximately $4,882,700. This equates to about $642 per forested acre. The area to be excavated by mining operations contains about 3,104 acres of forest. Current value of timber on the mine area proper is estimated to be $2,006,990, or about $646.50 per forested acre.

Proposed sediment ponds and spoil disposal areas would occupy about 774 acres, most of which (737 acres) is forested. The forest land on these areas contains timber worth about $677 per acre, or a total value of $499,212.

The generation facility and associated facilities, such as the ash disposal area, contain about 242.5 acres of forest land. The total value of timber on this tract is estimated at $167,775. For the generation facility site, per acre value of timber averages about $692.

The proposed EcoPlex would occupy about 1,500 acres along the southern end of the overall project area. Of this area, about 1,183 acres are in forest. Per acre value of timber on the EcoPlex site is

estimated to be approximately $350. Total value of timber on the proposed EcoPlex site is approximately $413,866.

There are about 2,334 forested acres within the study area on which timber and forest resources could be relatively unaffected by the proposed mining operations. The current value of this timber is estimated to be $1,794,860, or about $769 per acre.

3.12.5.2 Transmission Line and Natural Gas Pipeline Corridors

About 78% of the 2,977-acre area within the proposed transmission line Corridor A is occupied by forest land. A small portion of this forest land (about 160 acres) has recently been clear-cut. Because the proposed natural gas pipeline corridor would parallel Corridor A, forest characteristics for the pipeline ROW are comparable to those of Corridor A. Major forest types along the proposed route include deciduous, evergreen, plantation, and mixed forest. The primary hardwood species are oak, hickory, sweetgum, and yellow poplar. Loblolly pine is the predominant plantation forest species, and loblolly and shortleaf pine are the dominant conifers. The current value of the approximately 114 acres of timber in the proposed ROW is estimated to be about $75,000.

Within the transmission line Corridor B, about 122 acres of forest land would be required for the ROW. The current value of this timber is approximately $80,000.

Forest resources and characteristics within the ROWs of the proposed transmission line and the natural gas pipeline corridor are similar to those of the project area, and current standing timber values are assumed to be comparable to those of the 8,662-acre area examined in detail, i.e., about $650 per acre. No unique forest resources are known to occur along the proposed ROWs.

3.13 Cultural and Historical Resources

Occupation of the central Mississippi area began by the Middle Archaic Period (6,000 BC to 4,000 BC) with bands of hunters and gatherers utilizing natural resources that were seasonally available. This pattern of intermittent occupation appears to have continued until the region was settled by colonists from Georgia and South Carolina. Expansion of the American frontier led to the Choctaw cession of their traditional lands with the Treaty of Dancing Rabbit Creek in 1830. By that time, "sooners" from the east were already living and farming in the territory that would ultimately become Choctaw County. American settlement of the area was no doubt hastened as a result of the joint Chickasaw and Choctaw agreement that gave permission for the route of the Old Natchez Trace to be defined and used by travelers moving between Natchez, Mississippi and central Tennessee. Active nineteenth century use of the Trace was short-lived and the route was nearly abandoned by 1825.

The state of Mississippi was admitted to the Union in 1817 and Choctaw County was formed by the Legislature from Choctaw Cession lands in 1833. Initially, the County was 1,080 miles^2, but the creation of other counties and political gerrymandering led to the present configuration of the county in 1875. The county was ultimately reduced to 414 miles^2, less than one-half of its original size. Throughout these

four decades, tracts of land were patented and communities and towns were established, with various agricultural practices providing the means of subsistence, as well as defining the economic base of the County. Political controversy was not unknown locally, with the courthouse and various records being destroyed by fire on three occasions. The present Town of Ackerman was selected as the County Seat in 1896.

Little is formally known regarding prehistoric peoples' utilization of the county. Archaeological site location surveys have been largely limited to relatively small areas, such as borrow pit locations, road and highway alignments, and commercial construction sites. Pre-timber harvest surveys on the Tombigbee National Forest have provided the principal systematically-derived prehistoric settlement data for the County. Those surveys, combined with the Phase I archaeological site survey of the RHPP, have accounted for the definition of both the historic and prehistoric settlement patterns of the county.

Prior to the initiation of the field surveys for the proposed Red Hills Power Project, 26 sites had been formally recorded for the four 7.5-minute topographic map sheets (Tomnolen, Weir, Reform, and Ackerman) which encompass the RHPP area. In addition, three sites in Choctaw County have been listed on the National Register of Historic Places: (1) the James Drane House at French Camp; (2) Janet's Mound (22CH520) near French Camp; and (3) a portion of the Old Natchez Trace near Mathiston. These sites are at least five miles from the RHPP. The entire Old Natchez Trace is eligible for inclusion on the Register, and the current Natchez Trace Parkway (described in more detail in Sections 3.16, 3.20, and 3.21) is a historic designed cultural landscape potentially eligible for inclusion on the Register.

A Phase I Archaeological Survey of land that would be affected by the generation facility and the first five years of mine operations as outlined in Figure 2.2.2.3-2 was conducted in 1997. The survey method was approved by the Mississippi State Historic Preservation Office (SHPO) and consisted of walking 90+% of the area and shovel testing at regular intervals of 50 ft. All areas of bare ground were visually inspected for archaeological material. The survey discovered 54 sites. Of these 54 sites, 40 are historic homesteads, 8 are prehistoric, and 6 have both historic and prehistoric components.

Fourteen of the sites identified during the survey had enough integrity and potential to warrant Phase II survey testing to determine if they were eligible for inclusion in the Register. Results of the Phase I survey and the proposal for Phase II testing were submitted to the SHPO on September 23 and November 21, 1997. The SHPO, in a letter dated January 7, 1998, Appendix C-21, concurred with the determination and the Phase II archaeological testing. Seven of the fourteen sites would not be affected in the proposed first five years of the proposed mining activities and were not included in the Phase II testing survey. The Phase I survey was comprehensive and all areas of potential impact that had been identified for the RHPP area were tested. This includes not only the area to be mined, but the generation facility location, as well as the area that may be developed as a result of the construction of the generation facility and proposed EcoPlex industrial park.

Each of the sites that are included in the Phase II testing program will be covered by a one-meter grid, and one-meter square test units will be excavated at selected locations. These units will serve to help

delimit the size of the cultural deposit, both vertically and horizontally, as well as to determine if the site meets the Criteria for Admission to the Register. Additional 50-cm test units will be randomly placed around the periphery of each of the sites and excavated in 10-cm levels to insure that the boundaries are accurately determined. Site boundaries are being determined as the juncture between random verses non-random distribution of artifacts and the absence of anthropogenic soils. In the event that additional areas of potential development impact are identified and archaeological assessment is required, the same field methodologies that were used during the initial Phase I survey will be utilized.

The RHPP archaeological site survey area is marked on the south by the cemetery at Chester Baptist Church, on the west by the cemetery at Salem Methodist Church, and on the east by the cemetery at Mt. Nebo Church. A small family cemetery lies on the northern side of the RHPP area. This cemetery was established by the Tullos family and contains about 16 graves, and while they are marked with pieces of sandstone, the locations of the actual interments is questionable. According to Tullos family records, the first interments may have been a son and daughter, during the decade between 1830 and 1840. Another daughter, Margaret Hogan Tullos was buried there in 1854, followed by other members of the family including Archibald Tullos in 1855 and his wife in 1879. The cemetery is presently marked by a partially erected chain link fence that measures about 50-ft across the northern side. The eastern and western sides proscribe almost a triangular configuration that measures about 50-ft on the side.

In May 1997, historic structures were surveyed within the area of the proposed generation facility and the area of the first five years of proposed mine activities. This survey documented the architectural significance, and historical, as well as physical, integrity of all structures over 50 years old.

Twelve historic structures were identified in the area of the proposed generation facility and the first five years of mine activities. An additional 22 historic structures were identified in the surrounding area, including the community of Chester. All of these 34 structures were evaluated under the criteria for eligibility for listing on the National Register of Historic Places (36 CFR 60.4); none were considered eligible.

Results of the historic structure survey were submitted to the SHPO on July 10, 1997. In their concurrence letter of July 22, 1997 (Appendix C-22), the SHPO agreed that no historically significant structures occurred within the vicinity of the area of the proposed first five years of mining operations.

Transmission line and natural gas pipeline corridors will be surveyed subsequent to final route selection and center line staking. Any resources determined eligible for the NR will be avoided or any adverse impacts will be mitigated in accordance with a research design approved by MLMC, TVA, SHPO, and the Advisory Council on Historic Preservation.

3.14 Socioeconomics

3.14.1 Population

Choctaw County, in which the project would be located, has an estimated population of 9,285 persons as of 1996 (Table 3.14.1-1) (Bureau of the Census 1997). Choctaw County's labor market area (LMA) consists of those counties which border it. For purposes of this analysis, Lowndes County is included in the LMA because of its potential as a larger urban area (Columbus) to be impacted by, and provide services to, this proposed project. This LMA has an estimated 1996 population of 170,520 persons, over one-third of whom reside in Lowndes County. Oktibbeha County, the home of Starkville and MSU, already has important economic ties to Choctaw County; its urban center also makes it likely to be impacted by, and a contributor of, services for this project.

Since 1970, the total population in Choctaw County has increased by 10% (Tables 3.14.1-1 and 3.14.1-2). Within the LMA, only Lowndes and Oktibbeha Counties had faster growth rates, while both Attala and Montgomery Counties experienced population declines during this period. The LMA as a whole increased by 15.3%, due largely to the growth of Lowndes and Oktibbeha, the largest counties in the area. However, both Choctaw County and the LMA grew more slowly than the state as a whole. The state growth rate was 22.5% over this same time period.

Table 3.14.1-1 Population

	1970	1980	1990	1996
Choctaw County	8,440	8,996	9,071	9,285
Rest of LMA:				
Attala County	19,570	19,865	18,481	18,437
Lowndes County	49,700	57,304	59,308	61,203
Montgomery County	12,819	13,366	12,388	12,413
Oktibbeha County	28,752	36,018	38,375	39,303
Webster County	10,047	10,300	10,222	10,437
Winston County	18,406	19,474	19,433	19,442
Total, LMA	147,833	165,323	167,278	170,520
Mississippi	2,216,994	2,520,638	2,575,475	2,716,115

Table 3.14.1-2 Population, Percentage Increase				
	1970-1980	1980-1990	1990-1996	1970-1996
Choctaw County	6.6	0.8	2.4	10.0
Rest of LMA:				
Attala County	1.5	-7.0	-0.2	-5.8
Lowndes County	15.3	3.5	3.2	23.1
Montgomery County	3.5	-7.3	0.2	-3.2
Oktibbeha County	25.3	6.5	2.4	36.7
Webster County	2.5	-0.8	2.1	3.9
Winston County	5.8	-0.2	0.0	5.6
Total, LMA	11.8	1.2	1.9	15.3
Mississippi	13.7	2.2	5.5	22.5

The population of Choctaw County is about 70% white and 30% black, with a very small population of other races, and with only a small number of persons who identify themselves as being of Hispanic origin (Table 3.14.1-3). The LMA is about 62% white, with over 36% black, and a little more than 1% other races. The Hispanic origin population in the LMA represents only about 0.6% of the total population. The distribution in the LMA is very similar to the state as a whole. Choctaw County itself has a smaller share of minority population than does either the LMA or the state.

Table 3.14.1-3 Population by Race and Hispanic Origin, 1990								
	White		Black		Other		Hispanic Origin*	
	Population	%	Population	%	Population	%	Population	%
Choctaw County	6,319	66.7	2,731	30.1	21	0.2	31	0.3
Rest of LMA:								
Attala County	11,114	60.1	7,299	39.5	68	0.4	58	0.3
Lowndes County	36,736	61.9	22,041	37.2	531	0.9	491	0.8
Montgomery County	6,916	55.8	5,440	43.9	32	0.3	50	0.4
Oktibbeha County	24,064	62.7	13,171	34.3	1,140	3.0	330	0.9
Webster County	7,953	77.8	2,254	22.1	15	0.1	57	0.6
Winston County	11,151	57.4	8,094	41.7	188	1.0	70	0.4
Total, LMA	104,253	62.3	61,030	36.5	1,995	1.2	1,087	0.6
Mississippi**	1,633,461	63.5	915,057	35.6	24,698	1.0	15,931	0.6

*May be of any race.

**Does not add to adjusted total population, as shown in Table 3.14.1-1.

3.14.2 Employment and Income

According to the 1990 Census of Population, there were 3,285 employed residents of Choctaw County (Table 3.14.2-1). Of these, 1,759 worked in the county, with the remainder commuting to other areas. The two major destinations of these commuters were Webster County (480 commuters) just to the north, and Oktibbeha County (471 commuters) to the northeast, where Starkville and MSU are located. Only two other counties employed more than 100 Choctaw County residents: Winston County to the southeast (167) and Attala County to the southwest (138). Only one county, Winston, had as many as 100 of its residents working in Choctaw County (117).

The occupational distribution of jobs held by residents of the LMA is very similar to that of the state as a whole. However, compared to the nation, both the LMA and the state have relatively fewer workers in white collar jobs (managerial, professional, technical, sales, administrative) and relatively more in the lower-paying blue-collar jobs (e.g., operators, fabricators, and laborers). Choctaw County has an even larger share in blue-collar jobs. However, this includes precision production, craft, and repair jobs, many of which are among the higher-paying blue-collar jobs. The county's share of white-collar jobs is even lower than the LMA and the state.

Table 3.14.2-1 Employment of Residents by Occupation (%) 1990

	Choctaw County	LMA	Mississippi	United States
Managerial, Professional	16.7	22.1	21.5	26.4
Technical, Sales, Administrative	20.5	27.2	28.3	31.7
Service	11.6	12.3	12.3	13.2
Farming	4.3	2.9	3.4	2.5
Precision Production, Craft, Repair	17.4	12.6	12.9	11.3
Operators, Fabricators, Laborers	29.6	22.7	21.6	14.9

This occupational distribution is reflected in the income and poverty statistics for the county. Per capita personal income in Choctaw County is 72% of the state average and only 53% of the national average. The LMA has higher income levels, with per capita personal income at 92% of the state average and 67% of the national average. On the other hand, the share of Choctaw County residents with income below the poverty level is about the same as the state average and slightly lower than the LMA average (Table 3.14.2-2). However, the State, LMA, and county shares are all about twice the national average.

Table 3.14.2-2 Per Capita Income and Poverty Levels

	Per Capita Personal Income, 1994	Percent of Persons Below Poverty Level, 1989
Choctaw County	11,462	25.0
LMA	14,623	26.5
Mississippi	15,828	25.2
United States	21,696	13.1

The largest share of jobs in Choctaw County is in government, at 24.8%, followed closely by manufacturing at 24.4% (Table 3.14.2-3). Both of these are slightly above the LMA, somewhat more above the state levels, and well above the national levels. Choctaw County also has over 10% of its jobs in agriculture, more than twice the rate in the LMA and the state, and more than three times the national rate. Offsetting these high shares are relatively low shares in retail trade, services, and other industries.

Table 3.14.2-3 Distribution of Jobs (%), 1994

	Choctaw County	LMA	Mississippi	United States
Agriculture	10.1	4.6	4.9	3.3
Manufacturing	24.4	22.8	20.1	13.2
Retail Trade	9.1	15.6	15.8	16.8
Services	16.0	18.3	22.6	29.3
Government	24.8	22.3	18.5	15.0
Other	15.6	16.4	18.1	22.5

3.14.3 Housing

Choctaw County had a total of 3,217 occupied housing units in 1990, while the LMA as a whole had 59,899 (Table 3.14.3-1). In Choctaw County and, to a lesser extent, in the LMA, these units were largely owner-occupied, with relatively few rental units as compared to the state and the nation. The vacancy rate in Choctaw County was 9.1%, higher than in the LMA but somewhat lower than in the state and the nation.

Table 3.14.3-1 Housing Characteristics, 1990

	Choctaw County	LMA	Mississippi	United States
Occupied Housing Units	3,217	59,899	911,374	91,947,410
Homeowner	2,754	41,545	651,632	59,030,237
Rental	463	18,354	259,742	32,917,173
Persons per Occupied Unit	2.76	n/a	2.75	2.63
Vacancy Rates (%)	9.1	8.0	9.8	10.1

3.14.4 Local Government Revenues

Mississippi counties receive revenues from two major sources: ad valorem taxes and state shared intergovernmental revenues. During fiscal year (FY) 1996 to 1997, Choctaw County received a total of $2.78 million in tax revenue (Table 3.14.4-1). Fifty percent of this amount was from ad valorem tax sources, while 32% came from revenues shared by the state.

Table 3.14.4-1 Source of Funds ($ million), LMA Counties				
FY 1996-1997				
County	Ad Valorem Tax	State Shared Revenues	Other	Total Revenues
Attala	3.24	1.42	1.34	6.00
Choctaw	1.39	0.88	0.51	2.78
Lowndes	12.00	3.41	8.87	24.28
Montgomery	2.19	0.86	0.92	3.97
Oktibbeha	5.28	0.92	2.56	8.76
Webster	1.71	0.83	1.09	3.63
Winston	2.13	1.39	2.10	5.62
Total	27.94	9.71	17.39	55.04

During FY 1996 to 1997, the seven counties in the LMA received a combined total of approximately $55 million in revenue. Fifty-one percent of this amount was from ad valorem tax sources, while 18% came from revenues shared by the state. The remaining portion of county revenues comes from sources such as service charges, intergovernmental revenues from local and Federal sources, interest payments, fines, license and permit fees, and other miscellaneous sources.

The primary sources of municipal revenues are the ad valorem tax and sales tax. In FY 1996 to 1997, the seven largest cities and towns (those with more than 1,000 population) within the LMA received a combined total of approximately $37.6 million in tax revenue (Table 3.14.4-2). Sixteen percent of this amount was from ad valorem tax sources, and 37% came from sales tax revenues distributed by the state. The remaining portion of municipal revenues comes from miscellaneous sources such as privilege licenses, utility franchise charges, building permits, fines, and fees. Revenue amounts for these municipalities ranged from $16,339,655 for the City of Columbus to $633,973 for the Town of Ackerman during FY 1996 to 1997.

Table 3.14.4-2 Source of Funds ($ million), LMA Cities with Population over 1,000, FY 1996 to 1997				
City/Town	Ad Valorem Tax	Sales Tax	Other	Total Revenues
Ackerman	0.16	0.22	0.25	0.63
Columbus	3.14	6.66	6.54	16.34
Eupora	0.20	0.32	0.38	0.90
Kosciusko	0.52	1.53	1.09	3.14
Louisville	0.30	1.23	1.02	2.55
Starkville	1.40	3.20	7.40	12.00
Winona	0.32	0.77	0.96	2.05
Total	6.04	13.93	17.64	37.61

Mississippi school district revenues are primarily from intergovernmental sources. Choctaw County School District received a total of $8.5 million in revenues in FY 1996 to 1997. Revenues and revenue sources for the eleven school districts within the LMA are summarized in Section 3.14.5.1.

During fiscal year 1996 to 1997, gross tax collections by the Mississippi State Tax Commission totaled $4,265 million. Of this amount, $1,496 million or 35% was diverted for special uses, leaving $2,769 million for the State General Fund. The major source of Tax Commission collections are taxes on retail

sales of goods and services (either sales or use tax), and taxes on income of individuals and corporations (either income or corporate franchise tax).

Forty-five percent of the state's collections were raised from sales and use taxes; 30% came from individual income and corporate tax sources. Other state revenue collection sources include taxes on alcoholic beverages, tobacco, insurance premiums, gaming, petroleum, oil and gas severance, and various fees.

Portions of the moneys that are diverted for special uses are allocated to counties and municipalities. State collection sources that are allocated to county governments include: gaming fees and tax, alcoholic beverage tax, oil severance tax, auto tag fees, gas severance tax, and petroleum tax. During FY 1996 to 1997, the State allocated $0.88 million to Choctaw County and $9.71 million to the seven county governments within the LMA. State collection sources that are allocated to municipalities are sales tax, gaming fees and tax, insurance premium tax, and alcoholic beverage tax. Eighteen and one-half percent of the sales tax revenue is allocated to the municipality in which the funds were collected. Approximately $13.9 million of state sales tax collections were allocated to the seven largest municipalities within the LMA.

3.14.5 Community Services

3.14.5.1 Schools

Within the project LMA, there are 11 separate school systems. During the 1996 to 1997 academic school year, there were 30,480 students in attendance in grades 1-12 (Table 3.14.5.1-1). Of these school systems, six are administered under a county board, four are administered by a special separate school board, and one system is a combined city and county format. They provide special education, vocational, and general education (K-12) services.

Table 3.14.5.1-1 School District Enrollments, 1996-97 School Year

School District	Enrollment
Attala County	1,650
Kosciusko City	2,248
Choctaw County	2,099
Lowndes County	4,757
Columbus City	6,074
Montgomery County	764
Winona City	1,477
Oktibbeha County	1,511
Starkville City	4,077
Webster County	2,148
Winston Combined	3,675
Total	30,480

The average age of the facilities in these school systems is approximately 45 years. However, the majority of these facilities have had major renovation and modernization within the past three to five years. There are over 62 separate school facilities where education services are provided to the community.

Revenues of the various systems in the 1995 to 1996 school year ranged from less than $4 million to over $30 million (Table 3.14.5.1-2). Expenditures per student in Average Daily Membership (ADM) ranged from less than $4,000 in Choctaw County to more than $5,700 in Starkville. A majority of the funding for most of these school systems is from state revenues, with local revenues generally the second most important source (Table 3.14.5.1-2). Federal revenues generally covered between 10 and 20% of the total revenues (Table 3.14.5.1-3).

Table 3.14.5.1-2 School District Revenues, 1995 to 1996 School Year

School District:	Total Revenue	Revenue per ADM
Columbus City	$ 30,232,662	$ 4,977
Lowndes County	22,847,177	4,803
Attala County	6,978,758	4,230
Winston Combined	16,301,655	4,436
Kosciusko City	9,761,336	4,342
Webster County	8,710,505	4,055
Winona City	6,672,378	4,518
Starkville City	23,295,236	5,714
Choctaw County	8,246,564	3,929
Montgomery County	3,651,830	4,780
Oktibbeha County	7,421,973	4,912

Table 3.14.5.1-3 Revenue Sources (%), School Districts, 1995 to 1996 School Year

School District:	Local Revenue (%)	State Revenue (%)	Federal Revenue (%)
Columbus City	38.45	48.75	12.80
Lowndes County	32.39	57.00	10.61
Attala County	29.55	54.56	15.89
Winston Combined	20.49	63.23	16.27
Kosciusko City	30.81	58.58	10.61
Webster County	20.34	68.43	11.24
Winona City	19.67	65.08	15.25
Starkville City	37.88	48.02	14.11
Choctaw County	14.22	70.57	15.21
Montgomery County	20.44	60.04	19.52
Oktibbeha County	22.99	60.12	16.89

The school boards in the area provide transportation services to students. There are 318 buses within the eleven school systems available to transport those who need the service. Transportation availability seems to be adequate to provide for students currently attending the systems.

3.14.5.2 Water

There are about 139 water systems within the seven-county LMA serving 139,130 people, or about 83% of the population. These include water associations, municipal water systems, and water districts. Twenty-one (16%) of these systems are municipal systems. The remaining 118 (84%) are smaller systems serving small places and rural areas. Public water supply systems within the LMA provide for an average demand of over 22 mgd.

Among the municipal water systems, the City of Columbus Light and Water Department is the largest. This system serves approximately 30,000 people via 9,000 connections. The Town of Noxapater water system is the smallest municipal system which serves about 440 people via 275 connections. Columbus and Starkville are the only water systems serving more than 10,000 people within the LMA, although both the Kosciusko and Louisville systems serve nearly 10,000 people. The average daily demand and capacity of some of the larger municipal systems are shown in Table 3.14.5.2-1. The other municipal systems not listed can be characterized as very small having average daily demands of less than 500,000 gallons. According to the Mississippi State Department of Health, none of the municipal systems in the LMA exceed current capacity.

Table 3.14.5.2-1 Water Systems, Demand and Treatment Capacities, Municipalities over 1,000

City/Town	1990 Population	Average Daily Demand (mgd)	Design Capacity (mgd)	Excess Capacity (mgd)
Ackerman	1,573	0.5	1.4	0.9
Columbus*	23,799	5.2	8.0	2.8
Eupora	2,145	0.5	1.2	0.7
Kosciusko	6,989	1.8	3.0	1.2
Louisville	7,169	1.7	3.0	1.3
Starkville	18,458	3.8	7.4	3.6
Winona	5,705	0.7	2.0	1.3
Total	65,838	14.2	26.0	11.8

* An additional water treatment plant under construction will add 2 mgd capacity

Groundwater is the primary source of water for all systems within the LMA. All of the municipal systems use wells to supply groundwater. At least two small systems purchase their water. None of the municipal systems within the area rely on surface water as their source of water supply.

Many of the water systems in the LMA serve a small number of customers. The Golden Triangle Planning and Development District reports typical characteristics of such small water systems as higher user rates, insufficient revenue to offset operating and maintenance costs, inability to finance needed expansions and improvements, and inadequate fire protection capabilities because of pipe material and size. Other common problems are improper maintenance and overloaded systems.

Thirteen water systems serve parts of Choctaw County. Among these are municipal systems serving the Towns of Ackerman and Weir. Three water systems (Chester, Choctaw, and Reform Water Associations) serve rural areas within the central portion of the county in which the project will be located.

3.14.5.3 Sewer

There are 23 municipal wastewater systems within the LMA. According to the MDEQ, all are in compliance with federal and state effluent discharge requirements. Average daily flows range from 7.5 mgd in Columbus to less than 0.1 mgd in Crawford, Ethel, French Camp, Sturgis, and Walthall. Four wastewater systems within the LMA have flows that exceed 1.0 mgd: Columbus, Starkville, Kosciusko, and Winona. The average daily demand and capacity of wastewater systems in the larger communities are shown in Table 3.14.5.3-1.

Table 3.14.5.3-1 Sewer Systems, Demand, and Treatment Capacities, Municipalities over 1,000

City/Town	1990 Population	Avg. Daily Demand (mgd)	Design Capacity (mgd)	Excess Capacity (mgd)
Ackerman	1,573	0.16	0.24	0.08
Columbus	23,799	7.50	10.00	2.50
Eupora	2,145	0.16	0.52	0.36
Kosciusko	6,986	1.20	2.10	0.90
Louisville	7,169	0.90	1.20	0.30
Starkville*	18,458	4.20	5.00	0.80
Winona	5,705	0.65	1.00	0.35
Total	65,835	14.77	20.06	5.29

* Improvements starting in 1998 to add 4.5 mgd in capacity.

For the majority of the municipalities in the LMA, the use of sewage lagoons or oxidation ditches are the only affordable type of sewage treatment. Because of the prohibitive cost of rural sewer systems, the use of septic tanks is prevalent in rural areas. Within Choctaw County, municipal wastewater treatment systems are operated by the Towns of Ackerman and Weir.

3.14.5.4 Health

There are eight hospitals within the LMA with a total of 694 licensed beds, which represent an average of 3.9 beds per 1,000 persons. (See Table 3.14.5.4-1). Six hundred and thirty-nine of the licensed beds (92%) are acute care beds. The remaining 55 include adult psychiatric and chemical dependency unit beds at Baptist Memorial Hospital Golden Triangle in Columbus and adolescent chemical dependency unit beds at Choctaw County Medical Center in Ackerman.

Table 3.14.5.4-1 Hospitals and Emergency Ambulance Providers in LMA Counties

County	Hospital	Acute Care Licensed Beds (#)	Occupancy Rate/Acute Care (%)	Ambulance Providers in County (#)
Attala	Montfort Jones Memorial Hospital	72	30.90	2
Choctaw	Choctaw County Medical Center	10	33.09	1
Lowndes	Baptist Memorial Hospital Golden Triangle	285	34.07	2
Montgomery	Kilmichael Hospital	19	43.70	2
	Tyler Holmes Memorial Hospital	49	53.43	
Oktibbeha	Oktibbeha County Hospital	96	43.15	1
Webster	Webster Health Services	43	36.83	1
Winston	Winston County Community Hospital	65	27.66	1
Total		639		10

Each of the seven counties has at least one hospital; there are two hospitals in Montgomery County. All but one of the hospitals in the LMA have less than 100 acute care beds. The number of acute care beds per facility range from 285 at Baptist Memorial Hospital Golden Triangle to ten at Choctaw County Medical Center. Oktibbeha County Hospital in Starkville is the second largest hospital, with 96 beds. Oktibbeha and Lowndes Counties account for 60% of the total hospital beds available within the LMA.

Each of the eight hospitals are publicly owned and provide most basic services. While there is no Trauma Unit, all eight hospitals in the LMA have acute wards. The most comprehensive hospitals within the LMA are Baptist Memorial Hospital Golden Triangle and Oktibbeha County Hospital.

There are twelve certified rural health clinics in the LMA. Four of these are located in Choctaw County. There are ten ambulance services within the LMA, each county having at least one. The level of ground service in five counties is advanced life support with paramedics. Webster and Choctaw counties have basic life support. All counties are served by air ambulance services.

Choctaw County Medical Center is the only hospital in Choctaw County. The primary function of this hospital is patient stabilization and transfer. There is no orthopedic care or surgery practiced. Approximately 95% of transfer patients are transferred to Oktibbeha County Hospital in Starkville. Choctaw Medical Center has ten licensed acute care beds and 12 adolescent chemical dependency unit beds. The Medical Center operates an onsite nursing home, the county ambulance service, and is a certified rural health clinic.

Health facilities and manpower are critical needs within the LMA. The Golden Triangle Planning and Development District reports all counties within its service area, except Oktibbeha, have been designated as primary medical care under served areas by the Mississippi Department of Health. Low population density, low income status of many residents, rising health care costs, limited funds, and shortages of qualified personnel combine to challenge efforts to provide quality care to all residents. Problems

affecting emergency medical services, especially transportation and communications, are time, distance and reporting factors. Because of the rural nature of the area, these problems hamper proper medical treatment.

3.14.5.5 Law Enforcement

There are seven county sheriff's departments and ten city police departments within the LMA. In addition, the MSU has a police department in Starkville.

There are a total of about 250 local law enforcement officers serving communities within the LMA. These include 7 county sheriffs, 73 deputies, and 174 city police department officers. In addition, the MSU Police Department has 28 officers, and 5 District Highway Patrol officers are based in Starkville.

Over 160 (65%) of the region's city and county law enforcement officers are in Lowndes and Oktibbeha Counties. The sheriff's departments and police departments of the largest LMA counties and cities, respectively (i.e., Lowndes/Columbus and Oktibbeha/Starkville), are professionally managed and have the capabilities required for providing effective and comprehensive law enforcement services. Law enforcement capability is also generally adequate in the municipalities with populations over 5,000, such as Louisville, Kosciusko, and Winona.

Law enforcement is limited in the smaller towns and rural areas because of the lack of adequate financial resources to finance equipment and personnel necessary for the operation of an effective, full-time law enforcement agency. The practice of using auxiliary officers is frequently applied. Auxiliary officers are not required to be trained under Mississippi law and the smaller towns tend not to voluntarily pay for such training. Most law enforcement agencies have strained budgets and lack the resources needed for personnel and equipment.

Jail facilities in some counties need improvements, but with high costs of construction, capital improvements of this type have not been high priorities for local governments. Lowndes and Oktibbeha Counties have new detention facilities equipped with 288 and 82 beds, respectively. The average daily occupancy rate for these two facilities is significantly below capacity. Overall, the LMA has sufficient capacity for additional inmates, although some small facilities may be close to capacity.

3.14.5.6 Fire Protection

The LMA is served by a total of 56 fire departments. Forty-nine of these are volunteer departments, three are paid, and four are a combination of paid and volunteer. The three departments with full-time paid firefighters are Columbus, Starkville, and Winona. All of the fire departments serving rural areas are volunteer.

According to the Golden Triangle Planning and Development District, several areas within the LMA have no fire protection program of any type while others have only limited protection. Fire departments experience lengthy delays in responding to fire calls in remote areas. The limited protection in some areas is related to inadequate water line size and pressure, and by a limited number of hydrants. Many

municipalities have volunteer fire departments with only limited equipment. Many small towns lack the financial ability to operate full-time fire departments and to purchase needed fire-fighting equipment and vehicles.

Fire protection services are rated using a protection classification rating system. The rating consists of a scale of 1 to 10, with the best rating being 1. Ratings of fire departments are based on a detailed evaluation of a number of factors. These factors include personnel training, equipment levels, fire alarm systems, communication systems, station locations, fire hydrant facilities and locations, and water supply quantity and availability. The lower the numerical rating, the lower the insurance premium of service area customers is likely to be and vice-versa. Six departments in the seven-county area have ratings of 7 or less. The other 50 departments have ratings of 10 to 8. In Choctaw County, the Ackerman and Weir departments have Class 8 ratings; all others are Class 10.

Another indicator of fire department adequacy or preparedness is the number of training hours per man per year. This indicator ranges from a high average of 200 hours of training per man in the Columbus Fire Department to four hours in the Adation—Self Creek Fire Department (Oktibbeha County). Five departments report 100 or more hours of training per firefighter per year. Average annual training hours per man, for fire departments in Choctaw County, are as follows: Ackerman (40), Chester (10), French Camp (20), Panhandle (10), Simpson (5), and Weir (34).

3.14.6 Land Values

Market value of land varies with use, potential use, and location. For example, timberland within Choctaw County ranges in value from approximately $1,000 per acre to $8,000 per acre depending upon the quantity of timber present. Pastureland values range between $500 and $600 per acre. Cut-over land that is high-indexed (e.g., higher propensity to grow trees) ranges from $350 to $400 per acre. Low-indexed cut-over land ranges from $200 to $250 per acre.

The value of land on the project site ranges from $500 to $1,000 per acre. The average value of timber on project site land is $650 per acre.

The average estimated market value for an acre of farmland in Choctaw County, according to the 1992 Census of Agriculture, was $506. According to the Census, average land values for farmland in the other LMA counties ranged from $465 per acre in Attala County to $720 per acre in Oktibbeha County. The 1997 Census of Agriculture is not yet available.

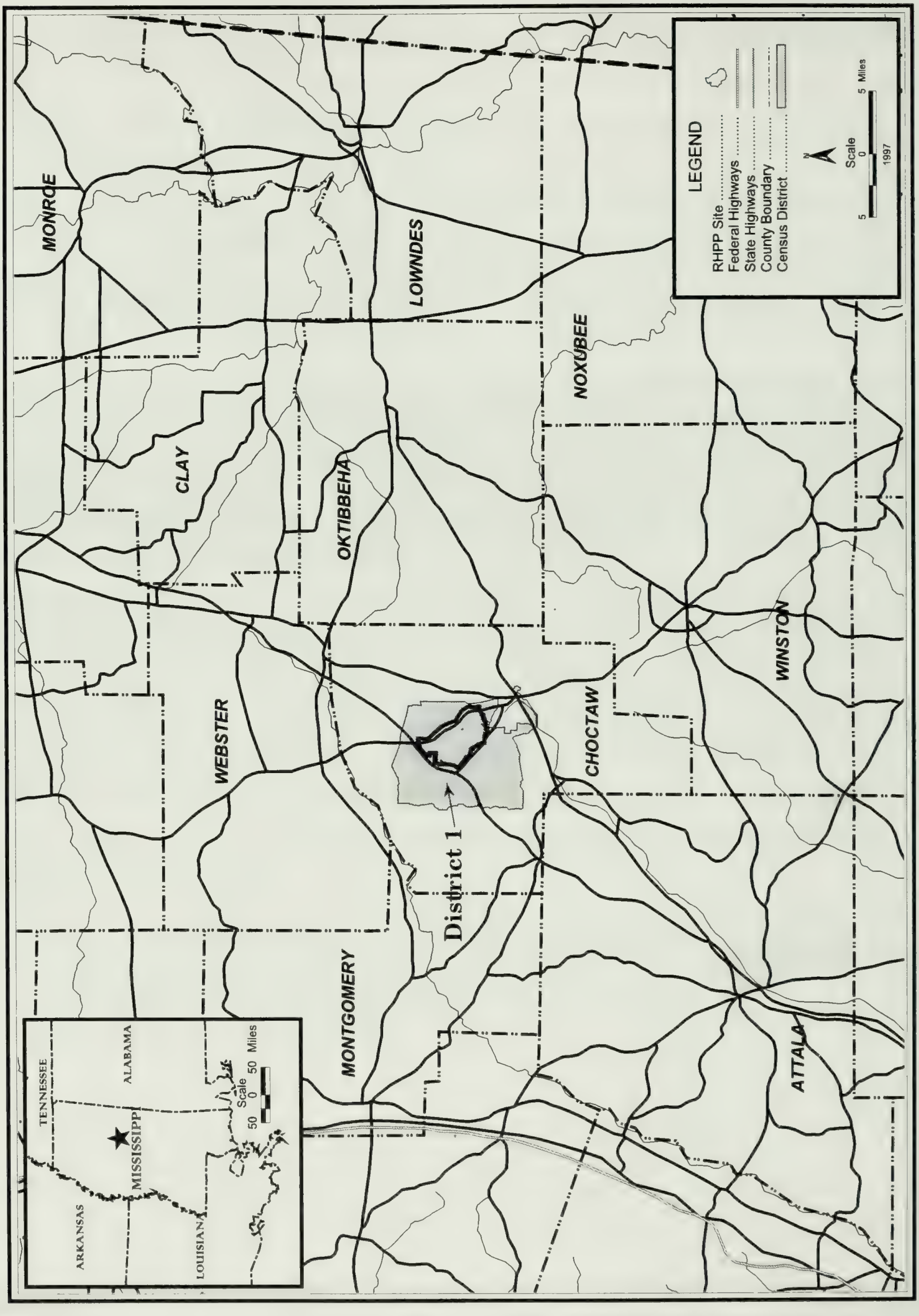
3.15 Environmental Justice

Executive Order (EO) No. 12898 directs certain federal agencies to consider environmental justice in the environmental reviews of their programs and activities. Although TVA is not one of the agencies identified in the EO, the agency has considered the issue of environmental justice as part of this EIS.

Environmental justice refers to the idea that no segment of the population should bear a disproportionate burden of health and environmental impacts of society's activities. Environmental justice concerns relate to the potential effects proposed actions might have on minority communities and low-income communities, and whether or not impacts are likely to fall disproportionately on minority and/or low-income members of the affected community.

Potential disproportionate impacts of the proposed project would likely affect persons living within or adjacent to the project site. Therefore, environmental justice analysis will concentrate on persons residing within the project area and the area immediately surrounding the project area. Choctaw County is divided into five Census districts. The proposed generation facility and mine sites are in Census District 1 (Figure 3.15-1). For purposes of environmental justice evaluation, persons residing within District 1 are the affected community. A summary of the population groups is shown in Table 4.15.1.3-1.

Figure 3.15-1 Environmental justice evaluation, areas of comparison.



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

3.16 Transportation Facilities

The transportation facilities that could possibly be impacted by this project include roadways, railroads, and airports.

3.16.1 Railroads

The nearest railroad lines to the proposed RHPP are the Kansas City Southern (KCS) Eastern class I line that runs through Ackerman 5.5 miles to the south and the Columbus and Greenville (C & G) class II line, ten miles to the north. The Interstate Commerce Commission defines class I railroads as those having annual gross freight revenues exceeding $250 million and class II railroads as those having annual gross freight revenues between $20 million and $250 million (MDOT 1995). The bed of an abandoned track lies within two miles to the east of the proposed site and runs north-south between the KCS line and the C & G line.

3.16.2 Airports

Several airports are located within a 120-mile radius of the proposed RHPP site. Some of these are shown in Table 3.16.2-1. The closest airport with air freight and jet capability is George M. Bryan located in Starkville and the closest airport with commercial airline service available is the Golden Triangle Regional Airport in Columbus (NEMA 1997). In order to be capable of handling air freight and jet service, an airport must have a minimum 5,000-ft, hard-surfaced, lighted runway (MSDECD 1997).

Table 3.16.2-1 Airports Surrounding the RHPP

Airport Name	ID	Location	Description	Road Distance (miles)
Ackerman Choctaw County	9M4	Ackerman	Unattended	5
George M. Bryan	STF	Mississippi State	Air freight and jet capable - Attended	29
Oktibbeha	M51	Starkville	Attended	30
Golden Triangle	GTR	Columbus	Air freight and jet capable Commercial Airline Service	54
Tupelo Municipal	TUP	Tupelo	Air freight and jet capable Commercial Airline Service	70
Jackson International	JAN	Jackson	Air freight and jet capable Commercial Airline Service	110

3.16.3 Roadways

Several two-lane gravel roads cross the proposed mining site that is bounded by the Natchez Trace Parkway to the northwest, Highway 415 to the southwest, Pensacola Road to the southeast, and Highway 9 to the northeast. No official traffic counts were found for these roads, so an alternate means of traffic estimation was used. The number of houses on each road were counted during a field survey,

and an average number of ten vehicle trips per dwelling unit per day was assumed based on trip generation data (Mehra and Keller 1985). Multiplying these two numbers yields an estimate of the average daily traffic for each gravel road. All roads in the mine area and their corresponding estimated daily traffic are shown in Table 3.16.3-1.

Table 3.16.3-1 Inter-Project Roads and Traffic Volumes

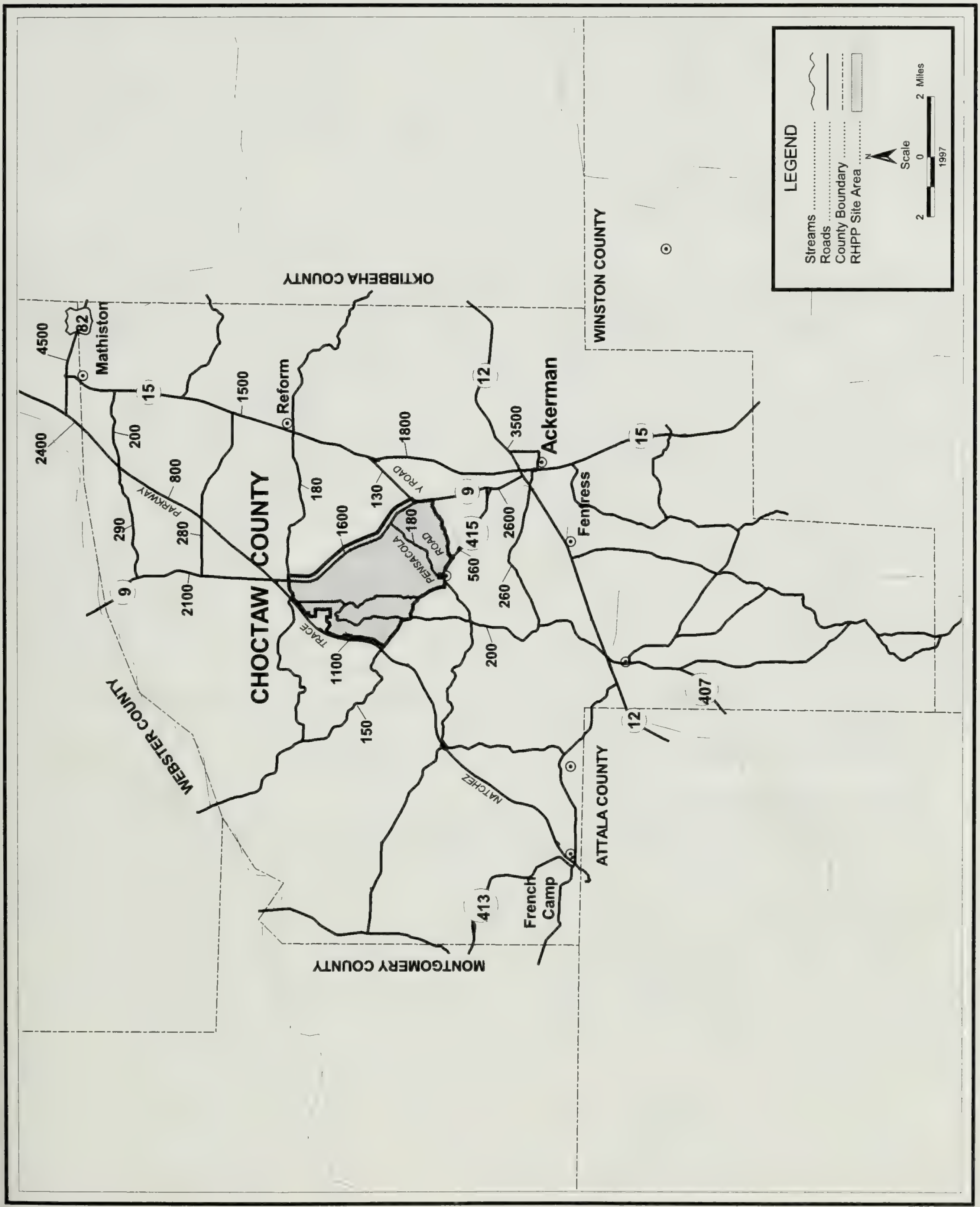
Road Name	Number of Houses	Estimated Daily Traffic (vehicles/day)
Bywy Road	3	30
McIntire Road	8	80
Nebo Road	5	50
Null Road	6	60
Prewitt Road	2	20

All of the roads listed in Tables 3.16.3-1 and 3.16.3-2 are gravel or chert covered with 20-ft widths, with the exception of Salem Bywy Road and Bywy Road. Salem Bywy Road is a 20-ft wide paved street with traffic markings until approximately two miles from Highway 415 where it then becomes a gravel road until its intersection with Park Road in the Jeff Busby developed area. Bywy Road is also a paved, 20-ft wide street.

Pensacola Road is a two-lane paved route that is also an inter-project road. It has a 20-ft width and 6-ft minimum clear distance (length from the edge of road to nearest obstruction) and forms the southeastern border of the RHPP. It has an estimated Average Daily Traffic (ADT) count of 180 vehicles per day (MDOT 1996). There is a 30% passing sight distance (length of road where passing is available relative to entire length of segment) due to its curved horizontal alignment. This road serves as a connector between Highways 415 and 9, which form the southwestern and northeastern borders, respectively, of the proposed RHPP. In anticipation of the RHPP, the Choctaw County Board of Supervisor plans to upgrade and realign Pensacola Road in 1998.

Several county and state two-lane highways surround the RHPP to serve the local traffic flow. Figure 3.16.3-1 is a map of the area with ADT counts on these surrounding roads. These routes also connect directly or indirectly to major thoroughfares, which in turn tie into surrounding cities.

Figure 3.16.3-1 RHPP area highways and corresponding ADT counts.



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

The two-lane highways that envelope the RHPP and a description of each follows.

- Highway 415 is a two-lane paved roadway with traffic markings. It is 24 ft wide with 6-ft shoulders from its intersection with Highway 9 to the southeast to Pensacola Road. This section also has a prevailing speed limit of 55 mph and 90% passing sight distance. From Pensacola Road northwest to Natchez Trace Parkway, Highway 415 still has a width of 24 ft, but the minimum clear distance decreases to two feet. Two curves of note are along this stretch with advisory speed limits of 45 mph and 25 mph. A bridge spans the Bowie Branch along this route and has a weight limit of eight tons. ADT on this roadway is 560 cars just south of the intersection of Pensacola Road (MDOT 1996).

- Highway 9 is a 24-ft wide, two-lane roadway with traffic markings that intersects Highway 12 to the south and the Natchez Trace Parkway and Highway 82 to the north. The section of road that borders the proposed project has a 6-ft minimum clear distance and a 55 mph posted speed. Conditions allow for approximately 70% passing sight distance in this area. An ADT of 1,600 cars was found on this section just north of Pensacola Road (MDOT 1996).

- The Y Road connects Highway 9 to Highway 15, which is a major connector to US Highway 82 to the north. The Y is a paved, 20-ft wide, two-lane roadway with a 6-ft minimum clear distance. A posted limit of 57,650 pounds is in effect. Geometry and topography allow for 100% passing sight distance along this stretch of road with a posted speed limit of 55 mph. The ADT for this section is 130 cars (MDOT 1996).

- Highway 15 is a two-lane paved road with 6-ft minimum clear distance that roughly parallels Highway 9 to the east. This stretch of road connects to Highway 12 just north of Ackerman and to US Highway 82 in neighboring Webster County. The predominant advisory speed limit is 55 mph. The mid portion of this road segment has a steep grade and horizontal curves which lend to 70% passing sight distance. An ADT of 1,800 vehicles per day was calculated just south of the intersection of Y Road and this section (MDOT 1996). Additional ADT counts of 1,500 and 2,400 were determined traveling north towards US Highway 82.

- Natchez Trace Parkway, a unit of the National Park System, is a two-lane, paved scenic roadway that was built and is maintained by the NPS. It is a designed landscaped roadway established for recreational use; hauling and commercial vehicles are prohibited. The maximum speed limit is 50 mph unless otherwise posted. The Parkway runs from southwest to northeast along the northern border of the RHPP, and is intersected by Highways 415 and 9. An ADT of 1,100 was reported on this segment just north of its intersection with Highway 415 (MDOT 1996). This is much lower than the Parkway's design capacity of 3,500 ADT vehicles determined necessary to sustain its recreational setting and desired visitor experiences.

Table 3.16.3-2 Data for Two-Lane Highways Surrounding RHPP

Road Name	Number of Lanes	Width (ft)	Pavement Markings	Min. Clear Distance (ft)	Maximum Load Limits	Average Daily Traffic (vehicles/day)
Highway 415	2	24	yes	2,4	16,000 lbs	560
Highway 9	2	24	yes	6	state law	1600
Highway 15	2	24	yes	6	68,000 lbs	1800
Pensacola Road	2	20	no	6	state law	180
Y Road	2	20	yes	6	57,650 lbs	130
Natchez Trace	2	20	yes	6	state law	1100

The roads mentioned above connect to several principal highways which provide access to surrounding cities. These highways are summarized in Table 3.16.3-3.

Table 3.16.3-3 Principal Connector Highways of the RHPP

Highway Name	Description	Destinations	ADT
US Highway 82	• Variable 2- and 4-lane	• Starkville - 18 miles east of Hwy 15	4,500
	• 6-ft min clear distance • 12-ft lane width	• I-55 - 40 miles west of Hwy 15	6,500
Highway 12	• Variable 2- and 4-lane	• Starkville - 24 miles east of Hwy 15	3,500
	• 4 bridges to NE with load limits	• Kosciusko - 29 miles SW of Hwy 15	4,100
	• 6-ft average clear distance • Narrow shoulders in areas	• Jackson - 104 miles SW of Hwy 15 via various road ways	
Highway15/25	• Variable 2- and 4-lane • 65 mph speed limit in areas	• Louisville - 14 miles south of Hwy 12	3,000

Both the roads immediately surrounding the RHPP and those that serve as connectors were assessed to qualify each one's existing Level of Service, (LOS). The concept of LOS addresses the quality of service, or operating conditions, provided by the roadway network, as perceived by motorists. Under this type of analysis, LOS is a qualitative measure that is described in terms of travel time, comfort, safety, and maneuvering freedom. This method of measurement incorporates various measurable factors associated with a particular segment of a roadway into the analysis. The service volume associated with a certain LOS is a maximum volume for that level. Six levels of service are designated as A through F, and are defined as differing qualities of service provided by a roadway. LOS A is defined as the highest quality of service which a particular class of highway can provide. It is a condition of free flow in which there is little or no restriction on speed or maneuverability caused by the presence of other vehicles. LOS B is a zone of stable flow. The restriction on maneuverability is negligible and there is little probability of major reduction in speed or flow. LOS C is a zone of stable flow but at this volume and density level most drivers are becoming restricted in their freedom to select speed, change lanes, or pass. LOS D approaches unstable flow, but tolerable average operating speeds are maintained however could be subject to considerable and sudden variation. This condition is tolerable for short periods of time. LOS E is unstable with lower operating speeds and some momentary stoppages. There is little independence of speed selection and maneuverability. The upper limit of this level is the capacity of the facility. LOS F indicates forced-flow operations at low speeds. The level of density increases to the effect of a traffic "jam." In this analysis,

LOS D can be viewed as the maximum allowable capacity of the roadway, as the conditions can be tolerable for short periods of time, or at peak hour conditions (Institute of Transportation Engineers 1982).

A LOS analysis was performed on the existing roads surrounding the proposed RHPP to determine baseline conditions. The ADT counts mentioned in Section 3.16 were used to calculate the traffic volumes for the 30th busiest hour of the year—the hour that is typically used to simulate the "rush hour." These hourly volumes were calculated as 14% of the ADT, which is common practice in transportation engineering (Pignataro 1973). Results of the analysis are shown in Table 3.16.3-4.

Table 3.16.3-4 Existing Peak Hour Volumes and Levels of Service

Road Name	Peak Hour Volume (Veh)	Level Of Service
Pensacola Road	27	A
Highway 415	94	A
Highway 9	210	B
Y Road	18	A
Highway 15	210	A
Natchez Trace Parkway	154	A
Highway 12	490	C
Highway 82	630	C

Conditions on all considered roadways have an LOS of C or better, so none of the roads are at their capacity, which would be LOS E, under present circumstances.

3.17 Public Health

3.17.1 Catastrophic Release of Toxic and Flammable Regulated Substances

EPA regulates stationary sources of certain toxic and flammable substances to protect public and environmental receptors from their potential hazardous effects. In 40 CFR Part 68, Chemical Accident Prevention Provisions, EPA sets forth the requirements on hazard assessment prevention programs, emergency response, regulated substances, and risk management planning for the potential accidental release of these materials. These requirements become effective June 21, 1999, and are the responsibility of stationary source owners and operators. They must assess their operations to determine if the requirements of 40 CFR 68 apply to them. If they do, then the owners and operators must follow-up on the remaining requirements. The tables found in subsection 40 CFR 68.130 identify the regulated substances and the threshold quantities that establish applicability for stationary source owners and operators.

Neighboring residents and people working near stationary sources that have these regulated substances are the public receptors of interest. National or state parks, forests, monuments, or designated wildlife preserves, sanctuaries, and refuges are environmental receptors that must be considered.

Airborne plumes of toxic substances follow the wind direction and velocity. They will disperse and widen in coverage to resemble a pie shape as they drift. The area of hazard from a toxic plume depends on many factors, including the quantity and rate of release, vapor or gas density, substance evaporation rates, variability in wind direction and velocity, and the substance toxicity and reactivity.

Flammables that ignite or detonate during the accidental release are hazardous over small areas immediately around the point of the accident. They radiate energy in the forms of fire and over pressurization that are not significantly effected by conditions. If the flammable plume does not ignite on release, it will drift similarly to the toxic plume until an ignition source is found or until its concentration drops below the lower explosive limit for the specific substance. Within a one-half-mile radius of the generation facility, there are seven residences (although it appears that three will have to removed to build the facility) and about 21 people. At the same radius from the center of the EcoPlex area there are about 12 residences housing about 36 people. Part of the EcoPlex is within the one-half-mile radius from the generation facility. These would be the areas of potential concern for catastrophic explosions or fires from these facilities. Currently, there are no industrial or commercial stationary sources of toxic or flammable hazardous materials in the general project area.

3.17.2 Air Pollutants

The Clean Air Act requires the establishment of National Ambient Air Quality Standards (NAAQS) to protect the public health with an adequate margin of safety. The Environmental Protection Agency has established such standards and these are shown in Table 3.2.2-1. The ambient air has been monitored for these pollutants and the results of this monitoring are shown in Table 3.2.2-2.

3.17.3 Radiological Impact

Residents of north central Mississippi are exposed to ionizing or nuclear radiation from natural-occurring radioactive materials. All people are exposed to varying levels of natural radiation. This exposure to natural radiation comes primarily from four different sources: cosmic radiation, terrestrial radiation, internal radiation, and radiation exposure from radon progeny. A description of each of these sources is in Appendix C-23. The annual dose equivalent amount of natural radiation from each of these sources is summarized in Table 3.17-1.

Table 3.17-1 Natural Radiation Exposures in the RHPP Area, Average Annual Dose Equivalent Rates

Cosmic Radiation	26 mrem/year (for most of the US, including all of MS)
Terrestrial Radiation	25 mrem/year
Internal Radiation	39 mrem/year
Radiation Exposure From Radon Progeny	200 mrem/year (approximately)
Total	290 mrem/year

Population doses from background radiation is a complex subject that has been widely studied (Eisenbud 1987, NCRP 1984, NCRP 1987a, NCRP 1987b, NCRP 1987c). In addition to the dose from naturally-

occurring radioactive materials, people receive ionizing radiation doses from medical and industrial sources and from other environmental sources such as the past atmospheric testing of atomic weapons. The total annual radioactive dose equivalent in the region of the RHPP is approximately 290 mrem.

3.18 Hazardous and Solid Waste

The affected environment as it pertains to the disposal of hazardous waste, used oil, and nonhazardous solid waste aspects of the RHPP is defined by the existing soil and groundwater conditions for the project area prior to the initiation of site construction activities. Any management of solid waste outdoors onsite has the potential for impacting the groundwater depending on the physical and chemical nature of the waste and the physical and chemical properties of the soil intervening between the waste, as managed, and the groundwater table below.

The project area is currently devoted primarily to forests (86.5%). The remaining area is covered mostly in pasture/grassland/hayland. The area devoted to commercial/institutional/utility use is less than 1%, and more than 90% of this is contributed by the existing TVA 500-kV transmission line ROW. The area proposed for the storage and/or disposal of fly ash and bed ash produced by the generation facility is currently predominantly in mixed forest, with a small portion in grassland/pasture/hayland. The nature of the existing vegetation determines the quantities and nature of the solid waste generated during clearing and grubbing of the site. Land use for the entire project area is discussed in greater detail in Section 3.12.

At least one sanitary landfill, no longer in use, occurs on the RHPP site. No hazardous waste disposal sites have been identified.

The soils of the project area are predominantly upland soils (72%), moderately to well-drained, and occurring typically on rolling to very steep ridges and hillsides. Other broad categories of soils included in the area are bottomland soils (28%) and hydric soils (less than 1%). Further details regarding specific soil types, etc., are provided in Section 3.4. The area proposed for ash storage is populated by the Providence silt loam, 5 to 8% slopes, the Ora loam, 8 to 12% slopes, and other soils that are coarser in texture (fine sandy loams) and steeper. These soils are typically well-drained, and provide textures ranging from sandy loams to silt loams in the surface and finer texture for the subsurface. Texture has a bearing on the ability of the soil to retain chemical contaminants and the permeability of the soil. However, this description, derived from the Choctaw County Soil Survey Report (USDA Soil Conservation Service 1986), applies to the shallow layers of the soil as they relate to agriculture and to such engineering activities as roads.

Information on soil and other geologic strata from ground surface to greater depth is obtained from geotechnical investigations conducted within the project area. Four borings were completed in the spring of 1997 to depths of 100 ft below ground surface within the proposed ash storage area. Samples were taken and analyzed for geotechnical and other physical properties. Parameters evaluated include grain size distribution, shrink-swell properties, strength, and vertical permeability. All of these borings were

completed as piezometric wells for the measurement of water levels. The results of this investigation are detailed in Appendix D of the Special/Industrial Waste Permit Application submitted to the State of Mississippi in August 1997 (Malcolm Pirnie, Inc. 1997b). Excerpts of relevant information are presented in Table 3.18-1.

Table 3.18-1 Geotechnical and Other Data from Borings in the Proposed Ash Storage Area

Parameter	Parameter Information from Boring No.			
	A1-1	A1-2	A1-3	A1-4
Position of boring on landscape[a]	Low; ground surface at ~495 ft-msl	Mid range; ground surface at ~550 ft-msl	High; ground surface at ~587 ft-msl	Mid range; ground surface at ~504 ft-msl
Texture of uppermost 11 to 22 ft of soil column	Stiff; tan and light gray clay (CH)[b] 0-22 ft	Stiff; tan sandy clay (CL)[b] 0-2 ft; firm tan silty sand 2-15.5 ft	Stiff; tan and light gray fine sandy clay (CL)[b] 0-11.5 ft	Soft; tan and light gray silty clay (CL)[b] 0-5 ft; very stiff gray clay 5-19 ft
Permeability of uppermost low-permeability layer(s) (cm/s)	9.46E-09 @ 8-10 ft and 1.66E-08 @ 18-20 ft	6.09E-08 @ 23-25 ft	No values reported	No values reported
Depth to free water[c] (elevation)	13 ft; (~482 ft-msl)	Not determined	Not determined	7.5 ft; (~496 ft-msl)
Comments on deeper zones of borehole	Clay from 52 to 100 ft	Clay from 15.5 to 100 ft	Clay from 22.5 to 48 ft	Clay soil from 32 to 100 ft

[a] Elevations estimated from topographic map contour values.
[b] Designation based on the Unified Soil Classification System; CL = sandy clays with low to medium plasticity (lean clays); CH = clays with high plasticity (fat clays).
[c] Measurements made on April 29, 1997.

For three of the four borings, the uppermost 11 to 22 ft of the soil column was comprised of a tan and light gray clay to silty clay material. For the fourth boring (A1-3), which was located higher on the landscape, this stiff silty clay layer occurred deeper in the soil column. Existing surface grades at the ash disposal site range from about 480 ft-msl to about 587 ft-msl. Clays and silts provide a higher specific surface and as a result tend to be better at retaining chemical species than the coarser sandy materials. Notably, for two of the borings (A1-1 and A1-2) a low permeability layer (less than 10^{-7} cm/s) occurred within 8 and 23 ft, respectively, of the ground surface. No values were reported for the other two borings. The extent to which this low permeability layer will be utilized in the design of the ash disposal area will depend on the continuity of the low permeability layer(s) and the grading (cut and fill) to be done to prepare the ash storage area for waste storage.

Water level measurements from within the proposed ash management unit are ongoing, in that a complete cycle of dry and wet weather has not been completed since the installation of the monitoring wells. Water levels observed with the initial completion of the borings ranged from 7.5 to 13 ft of ground surface after equilibration for borings A1-1 and A1-4. For the other two borings, no water was observed. More recent measurements indicate that, where comparisons can be made, the water levels have decreased since the spring. For a more detailed discussion of the hydrology of the project area, see Section 3.5.

3.19 Noise

3.19.1 Noise Background

EPA regulates environmental noise through the Noise Control Act of 1972 and the Quiet Communities Act of 1978. EPA developed and published environmental noise guidelines to protect public health (Office of Noise Abatement and Control 1974). Neither Choctaw County (Threadgill 1997) nor the state of Mississippi (LaFleur 1997 pers. comm.) has noise control limit statutes that apply to the area covered by this environmental review.

Concern about environmental noise exposure comes from two areas. The first is noise-induced hearing loss caused by prolonged exposure to high noise levels, and the second is community and personal annoyance caused by disturbance and disruption of normal activities.

Noise-induced hearing loss is a physical reaction to long-term exposure to loud noise. OSHA regulates noise in workplaces. OSHA's permissible exposure limit (PEL) is 90 dBA for an eight-hour work shift. Even at OSHA's PEL, some people could still experience noise-induced hearing loss over their working lifetimes. The National Institute for Occupational Safety and Health (NIOSH) recommends an exposure limit of 80 dBA for eight hours to prevent hearing loss in almost everyone, and EPA recommends a 70 dBA limit for continuous 24-hour exposure to prevent hearing loss in the general population.

Annoyance from environmental noise is very subjective. The annoyance could come from disturbances in communication and sleep or from the sense that the noise is intruding on individuals lives. Some people identify intruding noise, no matter what level it is, as an indication of change, and it is the change that is annoying. Impulsive noises, such as from pile driving, and high pitch or frequency tend to annoy people more than random tone, steady-state noise.

3.19.2 Noise Metric

Noise from industrial sources is usually made up of steady-state and fluctuating sounds. Steady-state noise comes from continuous processes and the fluctuating noise comes from other activities such as truck deliveries. It is difficult to express these noises in a simple term, or metric, that accounts for all of this variation. The equivalent sound level (L_{eq}) is a constant sound over a given period of time that has the same sound energy as the total of all noises measured during the same time period. The L_{eq} is usually used as the single metric for industrial noise over time.

A weighted noise measurement is used when determining the potential effects of noise on people. The dBA measurement scale approximates the response of the human ear by decreasing the importance of low frequency sound and emphasizing speech frequency sound.

EPA recommends using the dBA, equivalent sound level day/night (L_{DN}) as the metric in evaluating the potential effects of environmental noise (Office of Noise Abatement and Control 1974). The L_{DN} is a time-weighted combination of daytime (L_D) and nighttime (L_N) equivalent sound levels. The L_D is

weighted for 15 hours, and L_N is weighted for 9 hours and has 10 dB added to it because of the increased sensitivity to noise at night. EPA also recommends adapting, or normalizing, its L_{DN} guidelines for special reasons, such as pure tones, impact noise, or unusual community sensitivity.

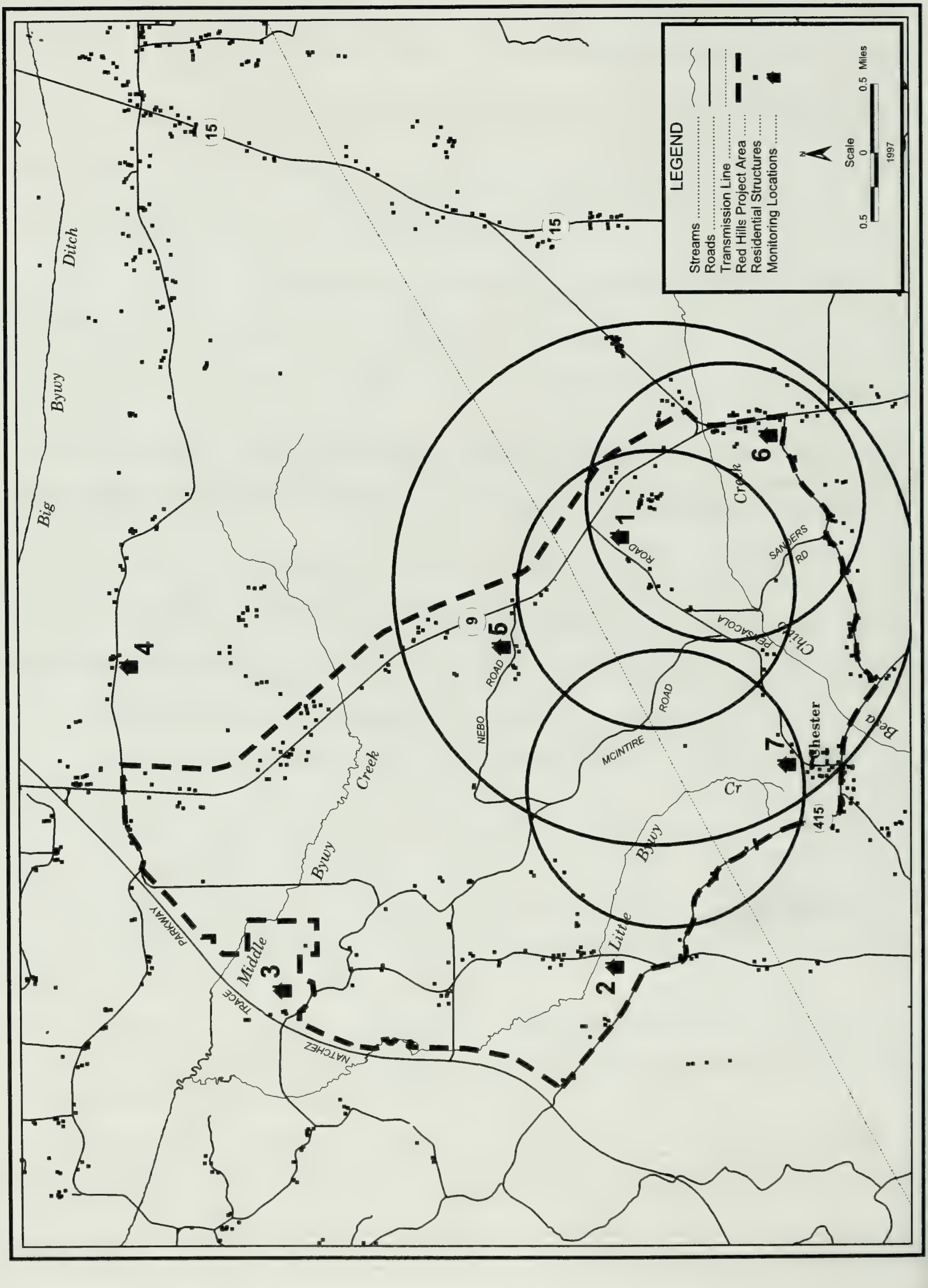
3.19.3 Current Population and Residential Environment

Estimates of the current population and number of residences in the study area come from two sources. In December 1996, a drive-by residential inventory was conducted. The base of this inventory was a Choctaw County map "Index for Real Property Ownership" produced for the county by Oliver Mitchell and Associates, Inc. The map identified all structures found in the county at the time it was published. The drive-by inventory updated the map's information by identifying new structures, eliminating removed structures, and verifying inhabitation of structures. As an estimate of population, it is assumed that three people live in each occupied structure, see Figure 3.19.3-1. The other population estimate comes from the county census that shows an average of 21.6 people per square mile in Choctaw County (Section 3.14.1).

The study area has primarily two housing patterns: (1) remote, low density, rural found away from the major highways; and (2) medium to high density rural found along the major highways, such as Highway 9. These housing patterns can be seen on Figure 3.19.3-1.

Table 3.19.3-1 presents the current population estimates for the entire study area, as well as sub-areas close to the major facilities of this project. The two-mile radius sub-area for the generation facility includes areas that are not part of the EIS study area. This additional area, about 1.5 $miles^2$, adds about 32 more people at 21.6 people per $miles^2$. The residential count in this additional area adds about 27 residences and about 81 people to the overall environmental noise review. The population estimates from the square mileage area estimates and from the residential counts reasonably compare except for the EcoPlex sub-area. This sub-area includes a significant portion of the Highway 9 population belt.

Figure 3.19.3-1 Noise monitoring sites.



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

Table 3.19.3-1 Population and Residential Estimates in the Red Hills Area

Study Area	Square Miles	Estimated Population[a]	Number of Residence	Residence Population[b]
Entire EIS Study Area	Approx. 26.5	572	262	786
Red Hills Generation Facility, 1-mile radius	3.1	68	20	60
Red Hills Generation Facility, 2-mile radius	12.6	271	105	315
Red Hills Lignite Mine, 1-mile radius, year 1	3.1	67	27	81
Red Hills EcoPlex, 1-mile radius	3.1	67	77	321
Trans. Line, new const. 2,000 ft wide				
Corridor A (south route)	3.2	69	--	--
Corridor B (north route)	1.9	41	--	--

[a] Estimated Population =21.6 people/miles^2 x miles^2.
[b] Residence Population=3 persons x residences.

These circular sub-areas around the facilities are only for establishing the affected noise environments. The propagation of noise from its source is usually not uniformly radial. It is effected by wind direction and velocity, natural and manmade noise barriers, and noise energy absorption along its path. These factors are accounted for during noise modeling that estimates impact on receptors.

3.19.4 Current Noise Environment

Ambient or background noise sources in the study area are predominantly from transportation, residential activities such as grass mowing, natural sources such as insects and tree frogs, and sporadic timber cutting. Truck traffic on Highway 9 dominates this noise environment which is also in the densest population area.

In order to predict the potential environmental noise impacts from the RHPP, background noise measurements were made at seven locations (Figure 3.19.3-1). These locations were chosen to give representative background noise levels at sensitive locations, such as Little Mountain Overlook at the Jeff Busby developed area on the Natchez Trace Parkway, and to account for population centers, such as Chester. Table 3.19.4-1, Background Noise Monitoring, presents the background noise levels measured during the four seasons, the yearly averages, and the location descriptions. These background equivalent sound level measurements were taken with Metrosonics 3070, Type II, integrating sound level meter and dosimeters set for A-weighting and slow response. Instruments were calibrated January 31, 1997, and were response checked before and after each field measurement.

Table 3.19.4-1 Background Noise Monitoring Results

	1	2	3	4	5	6	7
Noise Metric							
Winter measurements taken February 6-7,1997							
Winter L_{EQ}	45	44	42	45	51	47	44
L_D	50	50	47	52	59	53	51
L_N	37	34	34	33	39	37	32
L_{DN}	49	49	46	50	57	52	49
Spring measurements taken April 30 - May 1, 1997							
Spring L_{EQ}	48	47	47	48	51	55	49
L_D	49	48	47	50	53	58	50
L_N	46	44	46	45	49	47	48
L_{DN}	53	51	53	53	56	58	55
Summer measurements taken August 13-14, 1997							
Summer L_{EQ}	52	60	55	53	55	52	51
L_D	51	60	52	52	54	52	50
L_N	54	60	58	55	57	53	53
L_{DN}	60	66	64	61	63	59	59
Fall measurements taken October 23-24, 1997							
Fall L_{EQ}[1]	73	66	65	54	62	62	70
L_D[1]	74	67	63	55	62	61	68
L_N[1]	71	64	68	52	62	64	73
L_{DN}[1]	78	71	74	59	68	70	79
Averages do not include fall data							
Average L_{EQ}	49	56	51	50	53	52	49
L_D	50	56	49	51	56	55	50
L_N	50	55	54	51	53	49	49
L_{DN}	56	61	60	57	60	57	56
Yearly averages include fall data							
Year Ave. L_{eq}	68	62	61	53	59	58	65
L_D	69	63	59	54	60	59	63
L_N	66	61	64	52	59	60	68
L_{DN}	72	66	68	58	64	65	73

*Site 1 - Pensacola Road, 1/4 mile from Highway 9, east side
*Site 2 - Salem-Bywy Road, south of bridge, west side
*Site 3 - Little Mountain Overlook, 20 ft downhill
*Site 4 - Reform-Sturgis Road, at east Calwell Road intersection, south side
*Site 5 - Nebo Road, at cemetery boundary
*Site 6 - Chaney Road, 100 ft from Highway 9, north side
*Site 7 - Pensacola Road, near Chester, at corner of church property
[1] Non-representative data taken during thunderstorms. Will not be used in the review.

The average L_{DN} for the seven monitoring locations range from 56 to 61 dBA. Values do not include the fall measurements that were deemed non-representative because of severe thunderstorms during noise measurements. The winter noise measurements were the lowest and the summer measurements were the highest. Much of the summer noise came from natural sources such as insects, birds, and frogs commonly found in this rural setting. Overall L_{DN} average for the entire study area is 59 dBA. (NOTE: Again, this value does not include fall measurements.) Typical medium population density rural areas are expected to have annual average L_{DN} in the 50 to 52 dBA range (Harris 1991).

3.20 Recreation

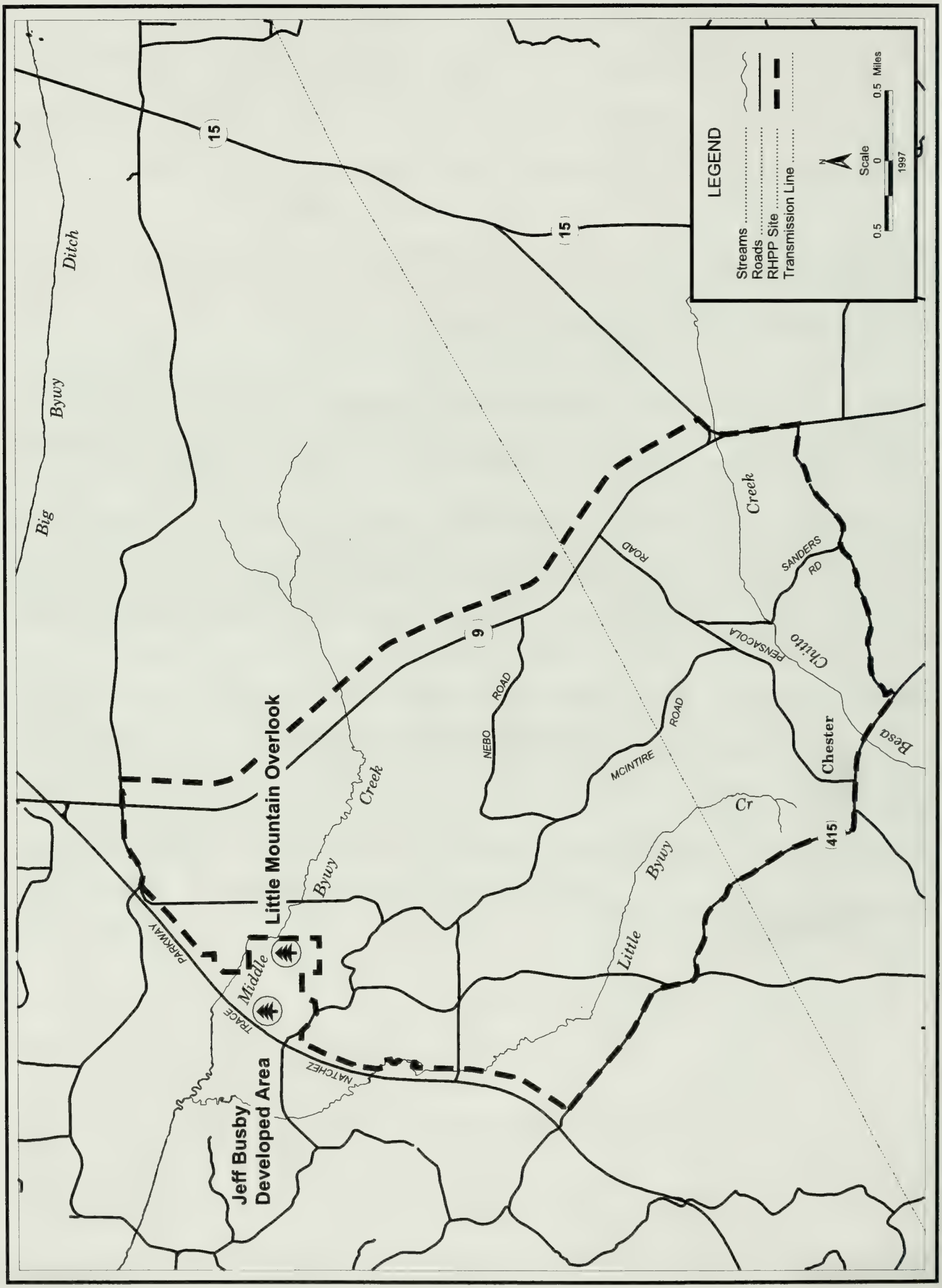
3.20.1 Existing Recreation Facilities and Opportunities

The only developed public recreation facility in the immediate vicinity of the proposed RHPP is the Natchez Trace Parkway (Parkway), a unit of the National Park System. The Parkway is contiguous with the northwest side of the RHPP site between approximately mileposts 191 and 196. The Parkway includes the 200-acre Little Mountain Overlook/Jeff Busby developed area (Figure 3.20.1-1).

Deer hunting is the primary recreation activity on the proposed site, followed by turkey and small game hunting. Most of the hunting is by landowners and guests, and members of hunting clubs which have leased large tracts owned by International Paper Company and Georgia Pacific Corporation. Approximately 20,000 to 25,000 acres in the county are leased by private hunt clubs. Few fishing opportunities occur, and these are restricted to a few small ponds.

Other recreation facilities are available in the surrounding area. The Ackerman Unit of Tombigbee National Forest, located a short distance southeast of Ackerman, includes the 100-acre Choctaw Lake, a public campground, and a day use area. The unit is also designated as the Choctaw State Wildlife Management Area. The Town of Ackerman operates Tom Glasgow Park which includes three baseball fields, six tennis courts, two multi-use courts, a walking trail, an amphitheater, and a playground. The Town also owns an additional softball field near the National Guard Armory. The Simpson Community in northeastern Choctaw County operates two softball fields and a swimming pool. Other developed recreation facilities in the county are associated with the schools.

Figure 3.20.1-1 Little Mtn Overlook/Jeff Busby developed area.



MAPS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

3.20.2 The Natchez Trace Parkway

The Parkway was established to commemorate the original Natchez Trace, a primitive trail stretching 500 miles through the wilderness from Natchez, Mississippi, to Nashville, Tennessee (NPS 1987). The original trace followed old American Indian trails and was used by boatmen, traders, and explorers returning to the eastern US after sailing down the Mississippi River, as a Federal postal road, and for troop movements during the War of 1812. In 1934, the US Congress commissioned the NPS to survey the old Indian trail known as Natchez Trace and plan a national road along this route (NPS 1987). The Parkway was officially established in 1938 and is presently about 98% completed. It was designated an All-American Road in 1996. In 1983 Congress designated the Parkway as the corridor for the Natchez Trace National Scenic Trail (NPS 1987). Subject to available funding, the scenic trail is envisioned to provide a walking/bicycle trail parallel to the Parkway; no completed trail segments presently exist in Choctaw County.

The Little Mountain Overlook/Jeff Busby developed area contains an 18-site campground, picnic area, educational exhibits, and a one-mile nature trail with interpretive signs. A 0.7-mile long road from the Parkway terminates at a scenic overlook on Little Mountain which, with an elevation of 603 ft, is one of the highest points on the Parkway in Mississippi (NPS 1994). The area was named after former US Congressman Thomas Jefferson Busby for his role in passing the 1934 legislation authorizing the Parkway. His contributions are acknowledged on a sign at the overlook.

Over 13,020,000 people traveled the Parkway during 1996 (NPS 1997). Although no visitation figures are available for the Choctaw County segment of the Parkway, about 367,000 people traveling in 216,000 vehicles visited the Little Mountain area during 1996 (NPS 1997). The campground was occupied for 1,139 recreational vehicle-nights and 375 tent-nights in 1996, for a year-round average occupancy rate of 23% (NPS 1997).

3.21 Visual Resources

3.21.1 General

The study area for visual resources consists of project areas for the generation facility, mine, and transmission line and natural gas pipeline corridors, along with land adjacent to these corridors, as well as the EcoPlex. It also includes the portion of Natchez Trace Parkway, as well as viewsheds of Highway 415, “Y” Road, and Highway 15 from “Y” Road to the Ackerman substation.

Landscape character gives a geographic area its visual and cultural image, and consists of the combination of physical, biological, and cultural attributes that make each landscape identifiable and unique (Anderson 1995). The general landscape character of the study area is described in this section with additional details in sections that follow.

The study area is a wooded rural countryside with occasional pasturelands, ponds, sparse residential development, and very few industrial features. The terrain is gently rolling with wide valleys, small streams, and dissected uplands. Together the natural and cultural elements form a generally harmonious mosaic of rural landscape.

More than 80% of the area is woodland, consisting of deciduous, evergreen, and mixed timber stands. Much of the woodland is commercial forest production which provides views of maturing stands, roadway buffers, evergreen plantations, clear-cuts, and various stages of regrowth on clear-cut tracts. The clear-cuts initially create sharp contrast and discord that disrupts the visual harmony of this landscape. It takes at least seven years after replanting until growth reaches 12 to 15 ft and begins to restore scenic integrity to the woodland. Views continue to change over time as stands rotate through the managed harvest and planting cycle.

A few man-made features can be seen above tree lines, including a couple of water tanks and a radio tower in Ackerman, as well as two towers on a ridge northeast of town along Dido Road. A TVA transmission line is located in the area and can be seen where it crosses roads. Outside of Ackerman, the only visible industry is the Alabama River Chip Mill. It is located south of powerline Corridor A, on Highway 12 near the intersection with Mt. Airy Road.

A variety of residences are seen in the study area, including mobile homes, small to medium size homes with wood siding, and small to large brick homes. Home sites vary from small wooded lots to large grassed areas with shade trees and out buildings. Several homes are farm residences. Many of the homes have vegetable gardens and some have ponds. The majority of residential development occurs along primary roads. Several churches and graveyards also occur in the area. Most are located on secondary roads within a mile of primary roads.

Views of the study area are examined in terms of foreground, middleground, and background distances. Foreground is considered the area within one-half mile of the observer. Within this zone texture, line, and color can be used to differentiate landscape objects. Middleground is the zone between foreground and background. It is normally the area between one-half mile and four miles from the observer. Texture, line, and color of landscape objects may be distinguishable, but contrast is weak and objects tend to merge into larger patterns. Background is the distant part of the landscape, usually the area four miles or more from the observer. Landscape objects are not normally discernible in the background unless they are especially large and standing alone. Textures are generally not visible and colors are lighter than the same object at closer range (EDAW 1997).

The study area is viewed by motorists on primary roads that form the area edges, and from the secondary roads crossing through it. Farms, homes, and churches located along these roads also view various parts of the area. The roads and their average daily traffic volumes are described in Section 3.16. The visual character of paved primary roads includes long, gentle horizontal and vertical curves, open grass rights-of way, and generally light traffic. Woodlands line both sides, with occasional openings created by home sites, pastures, or timber harvest activity. Views are primarily foreground and middleground, with

occasional views to background from open elevated areas. The character of gravel secondary roads includes sharper more frequent curves, narrower right of ways, minimal road shoulders, and very little traffic. Woodlands grow close to the roadway on both sides, with openings for timber harvest activity, farms, and occasional home sites. Views are predominantly foreground, with an occasional view to middleground and background when crossing a ridge or passing pastures and clear-cut lands.

Night Sky

The following discussion is extracted from a report prepared by Clanton (1997). Rainwater Observatory and Planetarium is located at French Camp, MS, about ten miles southwest of the project site. The facility is owned and operated by French Camp Academy, a private boarding school for disadvantaged children grades K-12 that was founded by a Christian group over 100 years ago. The observatory is the largest in the state with 17 telescopes and its mission is primarily educational. It is also open to scout, church, and civic groups. The observatory may operate at all hours of the day and night. Groups of small children use the telescopes earlier in the evening and more serious astronomical work is conducted after midnight.

The observatory director pointed out that nighttime satellite imagery shows the dark night sky in this region of Mississippi is somewhat unique in the Southeastern United States. This level of darkness is a result of very little urban development to produce waste light glow and brighten the night sky. No industrial, commercial, or large residential developments exist within the project area. The only light currently added to the night sky is from occasional security lights at farms and rural homes.

Table 3.21.1-1 shows the midnight sky cover data from several locations near the project, as recorded in the September 1996 climate summary from the National Climatic Data Center. From this data it is estimated an average of 200 or more nights each year are clear, or have scattered cloud cover, and are available for observation.

Table 3.21.1-1 Type and Percent Annual Frequency of Sky Cover at Midnight

	Jackson, Mississippi	Columbus AFB, Mississippi	Tupelo, Mississippi
Clear	39.3% (143 nights)	33.6% (124 nights)	35.6% (130 nights)
Scattered Clouds	16.7% (61 nights)	23.6% (86 nights)	19.7% (72 nights)
Broken Clouds	13.0% (47 nights)	15.3% (57 nights)	14.2% (52 nights)
Overcast	31.1% (114 nights)	26.9% (98 nights)	30.5% (111 nights)

To obtain measurements of the existing background sky luminance, the director of Rainwater Observatory used an Optec® SSP-3 photometer with a visual-range filter. Several relative light measurements were taken during the months of October and November in 1997. The measurements recorded differences in contrast between the Milky Way and the background night sky.

On typical clear nights, the Milky Way appears to be about 34% brighter than the background sky when viewed from Rainwater Observatory. The greatest contrast, 53% brighter than the background, is seen on only the clearest nights. Based on estimates of the cumulative brightness of stars in the Milky Way

(Garstang 1997) and measurements taken, background sky luminance at the observatory is calculated to be between 0.0004 and 0.0006 candelas per square meter, making it a better-than-average dark sky site.

A darker background sky allows astronomical objects of lesser brightness to be seen and there is a wide range of brightness among astronomical objects. The observatory is sensitive to any increase in background sky brightness because of the potential impact on its educational and scientific activities. Any increase would reduce the number of objects that can be seen by observatory users. A small background brightness increase of between 1.04 and 1.27 times (due to a football field in Weir) has been significant enough to make it impossible for telescope users to focus on the arms of the Whirlpool Galaxy.

In order for an object to be visible to the naked eye, its contrast must appear to be 10% brighter than the background sky. As background brightness increases, some objects can no longer be seen due to insufficient contrast. The observatory director estimates that if the background brightness increases by 2.5 times, it will be difficult or impossible to see one or two of the stars in the Little Dipper constellation (at the connection between the handle and the bowl) with the naked eye. Of the six visible stars in the Pleiades constellation, only two or three of them will still be visible to the naked eye if the night sky brightness increases about 50 times.

Table 3.21.1-2 shows calculated changes in contrast between the Milky Way and the background sky due to increasing levels of background sky brightness. If the background brightness increases by a factor of about four times, the Milky Way will become difficult to see with the naked eye on clear nights. A brightness increase of about six times will have the same effect on the clearest nights. A background brightness increase of seven times or more is very likely to render the Milky Way invisible to the naked eye on any night.

Table 3.21.1-2 Predicted Changes in Contrast Due to Increases in Background Sky Brightness

Brightness Increase Factor	Typical Milky Way Contrast (clear nights)	Greatest Milky Way Contrast (very clear nights)
0 times (no increase)	34.1%	53.2%
1.25 times	27.3%	42.6%
1.5 times	22.8%	35.5%
2 times	17.1%	26.6%
5 times	6.8%	10.6%
10 times	3.4%	5.3%
15 times	2.3%	3.5%
17 times	2.0%	3.1%
20 times	1.7%	2.7%

3.21.2 Natchez Trace Parkway

The northern portion of the mine area is close to a five-mile section of the Parkway, a unit of the National Park System administered by the NPS (Figure 3.20.1-1). The Parkway lands in the area which are currently undeveloped are zoned as a Natural Zone and are managed to perpetuate natural ecological processes with little or no alteration pursuant to federal statute and NPS policy. Parkway lands used in conjunction with the existing Parkway recreational road and developed areas are zoned Development Zone, and managed to provide and maintain facilities serving visitors and values. All Parkway lands are managed to insure that park visitors are afforded a continuous, serene, and recreational travel setting, highlighting the diverse traditional rural southern landscapes along its route.

The Parkway near the site crosses a broad plain where two valleys join, and the elevation changes less than 30 ft through this section. Southeastern views to the proposed mine area are restricted by a forest buffer with a varying width of 300 to 500 ft on NPS property. The maturing woodland varies from evergreen to deciduous in a mix that changes along the route. When leaves have dropped, occasional limited middleground views may be available through the buffer to clear-cut areas beyond. A dense young evergreen plantation about 15 ft high is growing in the last forest opening on the southern side of this section.

There are few overlook areas provided along the Parkway in Mississippi. The topography has relatively little elevation change and suitable vantage points are rare. At Parkway milepost 193.1, NPS property includes Jeff Busby developed area, which surrounds Little Mountain (Figure 3.21.2-1). Visitors have an opportunity to view the characteristic landscape of this region from a mountain top overlook, about 200 ft above the Parkway and surrounding valleys. The landscape perspective obtained from the Little Mountain Overlook provides both a unique vista experience for Parkway visitors and an appreciation of the traditional rural southern landscape typifying the surrounding portion of Mississippi. The Jeff Busby developed area is regarded as an important stop on the Parkway.

A gas station, convenience store, and parking are located at the entrance to the developed area. Picnic facilities and the campground are nearby in dense, mixed woodland at the base of the mountain. Views from the campground and picnic area are limited to immediate foreground due to the surrounding topography and woodland buffers. A nature trail is located in deciduous woods along the eastern side of the mountain, connecting the campground and overlook. Views from the trail are restricted to immediate woodland foreground most of the year. When leaves are gone, trail users may have an occasional middleground view of scheduled mining areas east of the mountain. Summit Road provides a woods-lined access drive to nature trail parking, then continues to the Overlook parking area and interpretive pavilion on the mountain top. From the Overlook there are broad panoramic views looking east 15 miles or more, across several wooded ridge lines. These views are framed by deciduous trees on each side and deciduous vegetation in the low foreground. The mine site and development along Highway 9 are obscured by the foreground vegetation, only the middleground and background areas are seen (Figure 3.21.2-2). These eastern views expand somewhat after the leaves fall. Looking west, away from the

mine site, panoramic views are similar but not as broad. They are framed with deciduous and large evergreen trees, and the low foreground is screened with evergreens. Looking south, a stand of trees in the immediate foreground across the end of the overlook screens the NPS water tank and landscape beyond. After leaves fall, a limited view of clear-cut regrowth and background ridges may be available through the trees. If these trees were removed, views would be open to the mine area in the middleground and the generation facility site in the background. Figure 3.21.2-3 shows the proposed project area and land uses in relation to forest cover, clear-cut areas, and various stages of woodland growth surrounding Little Mountain.

Figure 3.21.2-1 Little Mountain at Jeff Busby developed area, Natchez Trace Parkway.

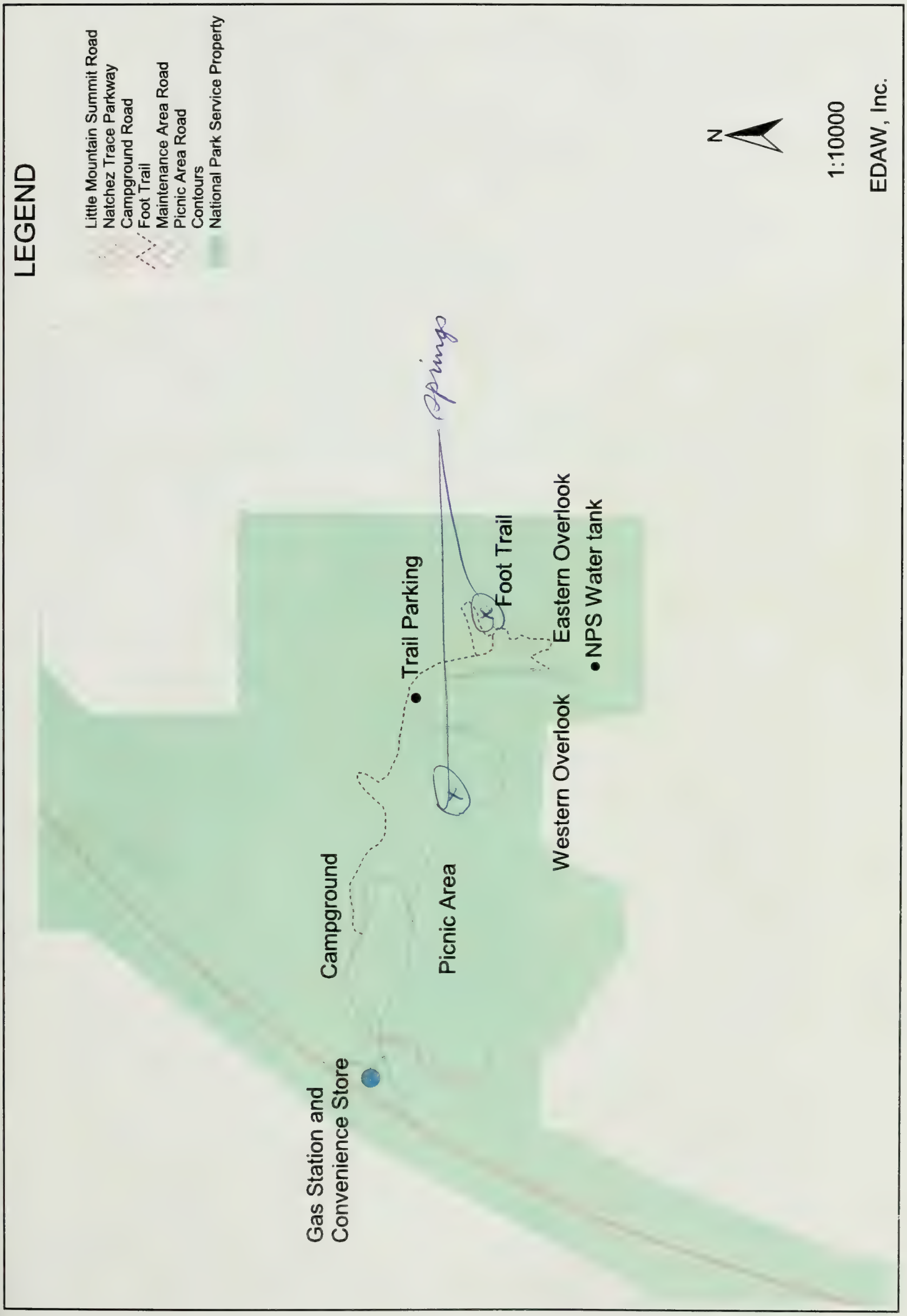


Figure 3.21.2-2 View from Little Mountain Overlook, facing east, summer 1997.

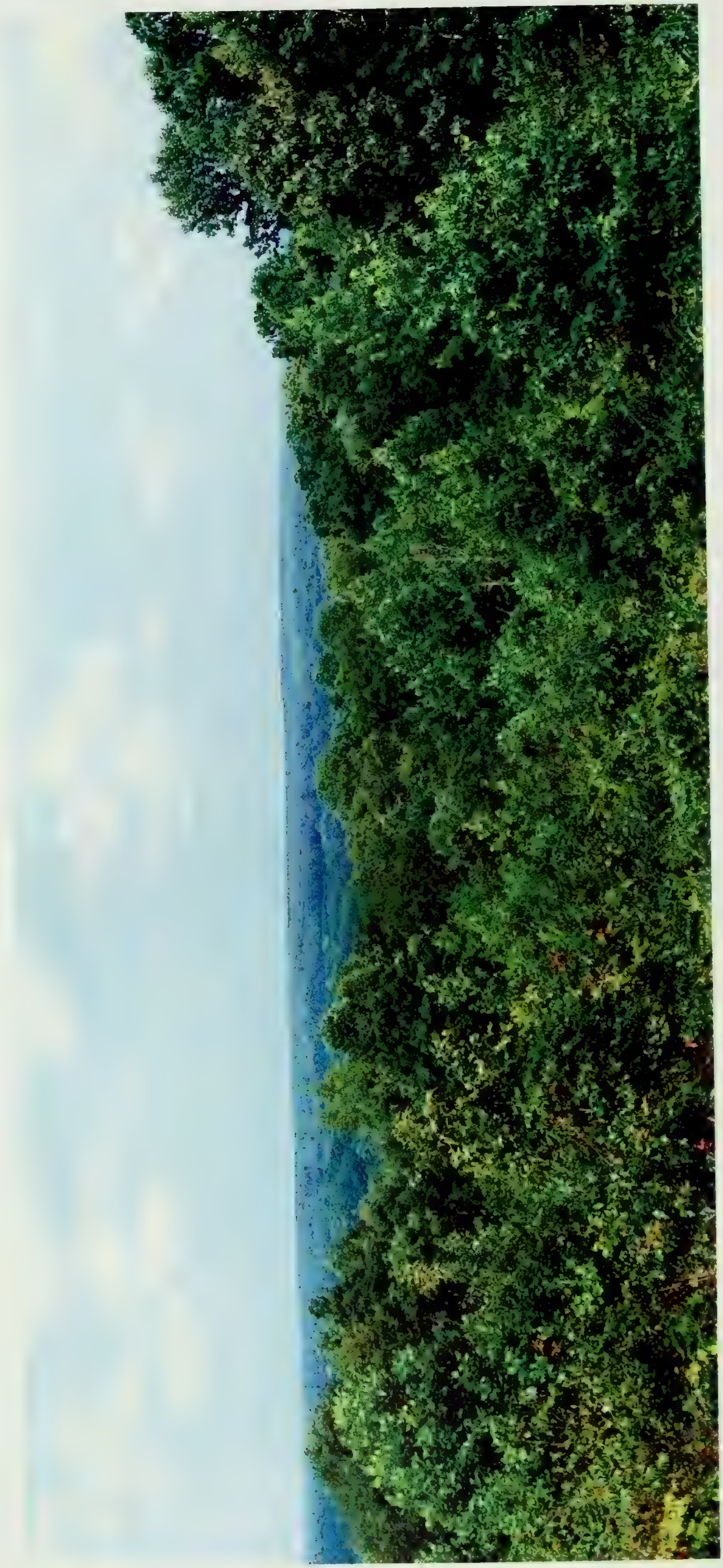
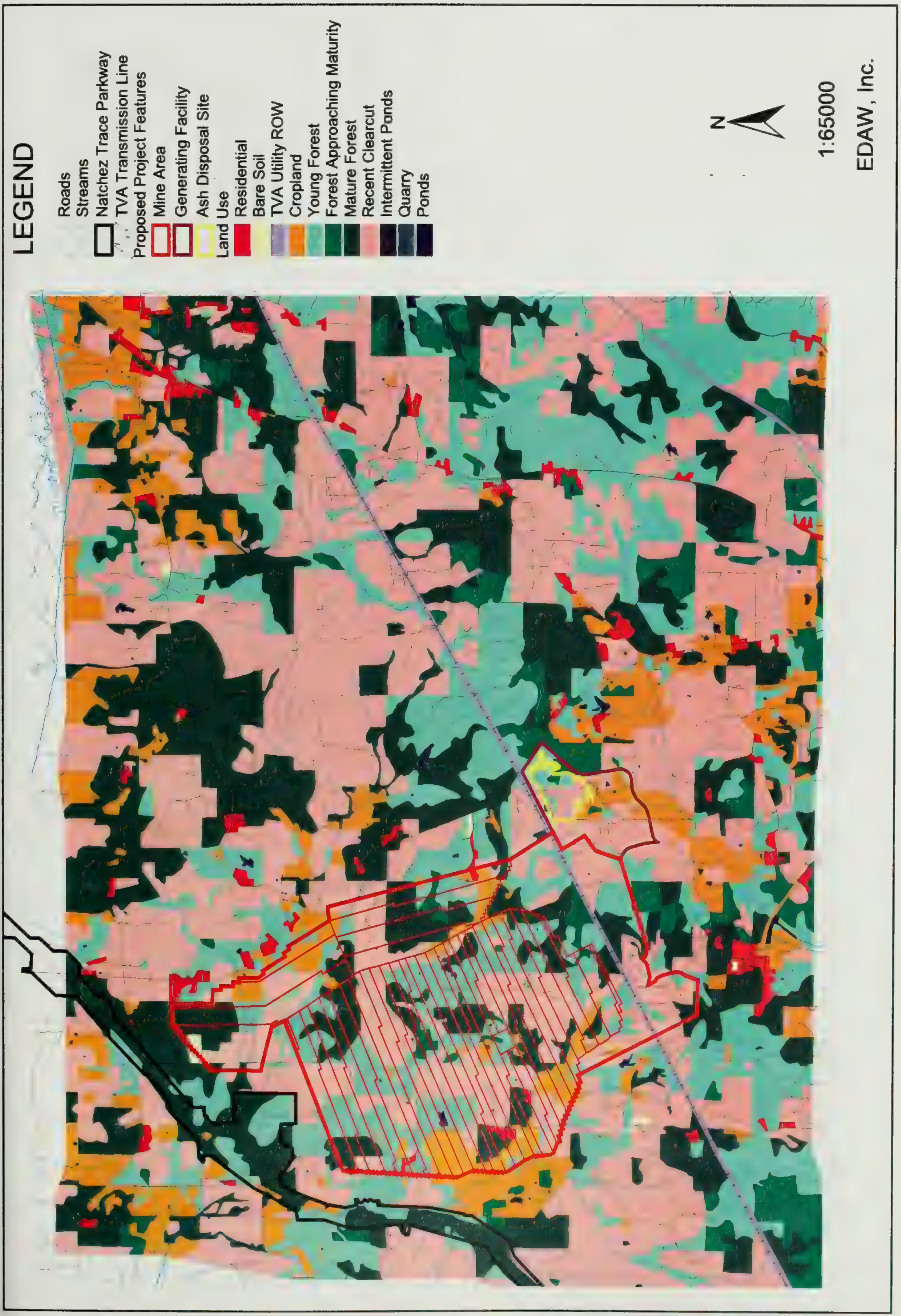


Figure 3.21.2-3 Visual land use pattern and project features southeast of Jeff Busby developed area.

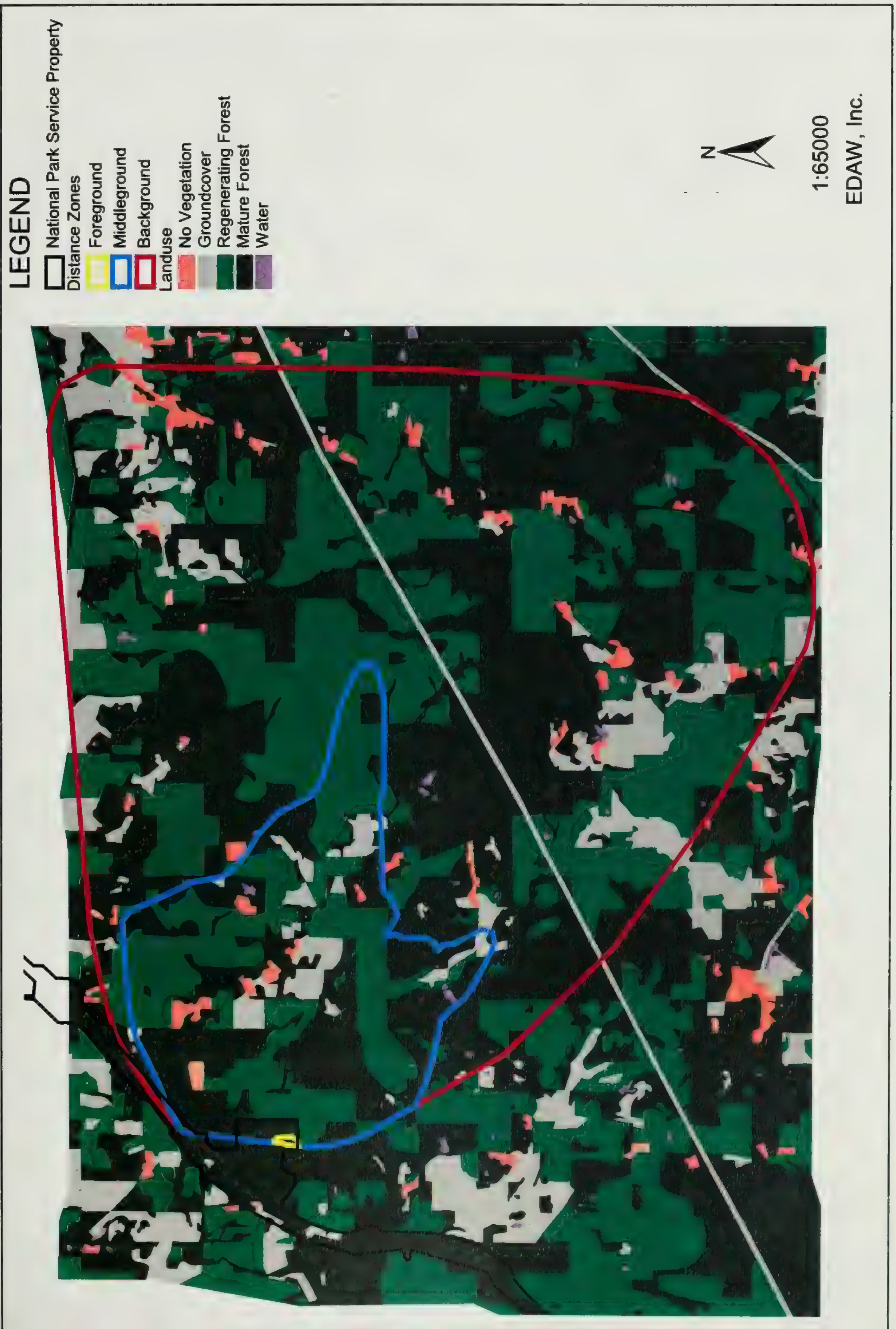


Views from Little Mountain extend to the distant horizon. Significant foreground vegetation has been cleared at both the eastern and western facing overlooks to open the view to the middleground and background. The vegetation patterns in the middleground and background give the impression of an unspoiled landscape. However, at such distances it is not possible to notice detail that reveals timber industry activity. Although timber production forests represent the majority of forested types in the county, from the eastern facing overlook, the dominant visual impression is first of a natural forest system. At closer inspection however, it is possible to see the forested areas as a mosaic of regeneration stages. Fast growing pine is the dominant forest type, especially in areas that have been recently harvested (EDAW 1997).

Long distance views have poor definition during the summer months due to hazy conditions created by moist tropical air from the Gulf of Mexico. Summers are typically long, hot, and humid, while winters are cool but fairly short. Because there is less humidity in winter, distant views are clearer and extend further than in summer (EDAW 1997).

There are few cultural features visible from Little Mountain other than forest management practices. Therefore, in this area, landscape character is limited to forest types. Categories are mature forest, recently clear-cut forests where bare soil is still visible, and clear-cut where vegetation has sufficiently grown back to cover the surface and trees are emerging from the ground cover. Figure 3.21.2-4 shows these areas in relation to viewing distances from the eastern facing overlook (EDAW 1997).

Figure 3.21.2-4 Viewing distance zones, with forest types that influence landscape character, facing east.

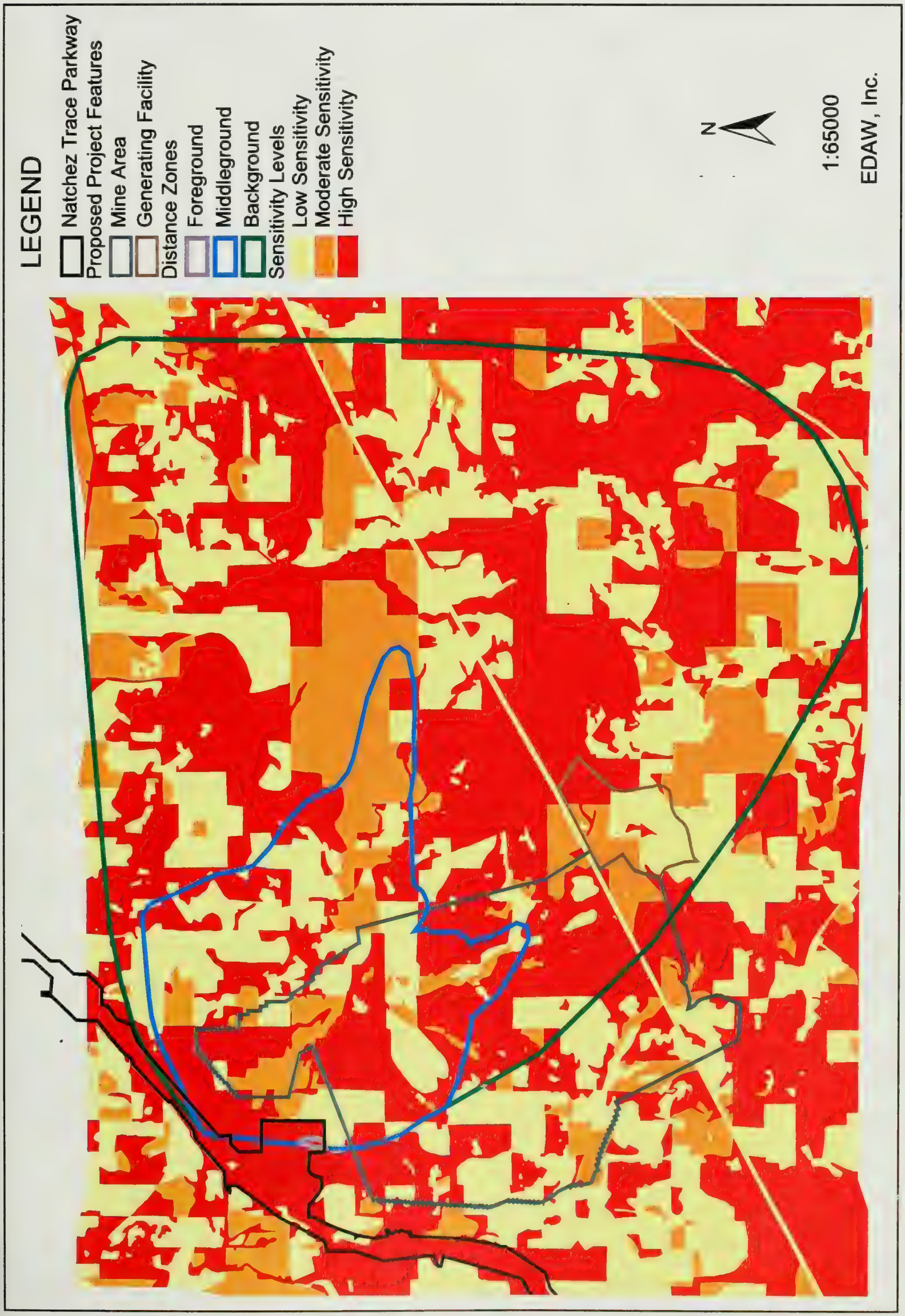


In visual assessment studies, scenic attractiveness is often described using the following adjectives: variety, unity, coherence, vividness, harmony, mystery, and uniqueness (Anderson 1995). The study area, when it is described in this way, is unified, intact, and coherent from the eastern facing overlook on Little Mountain. Middleground views have a continuous forest cover of varying regeneration stages. Clear-cut areas visible in the background, lose texture and depth because of their distance, and therefore have little or no visual impact (EDAW 1997).

The view from Little Mountain is low in variety because the scenery is similar in all directions and does not provide a sense of mystery, vividness, or uniqueness.

Scenic Integrity indicates the degree of intactness or wholeness of the landscape character (Anderson 1995). The scenic integrity from the eastern facing overlook at Little Mountain is relatively high. Clear-cuts and agriculture are screened from view and the visible terrain is composed of mixed deciduous/evergreen forest. The zones of sensitivity within the various viewing distances are shown in Figure 3.21.2-5. The high sensitivity zones consist primarily of mature forest areas. Altering the vegetation pattern by removing this mature forest would cause the greatest disruption to scenic integrity.

Figure 3.21.2-5 Scenic sensitivity zones, in relation to viewing distancesand project features, facing east.



3.21.3 Mine Site

The mine area consists of two valleys which drain to the north. They are divided by a ridge which lays in a north-south direction. The gently sloping valleys average 400 ft wide and 1,800 ft long, with about 50 ft of elevation drop from south to north. The elevation difference from valley to ridge line is about 140 ft and another 50 ft to the high points. The ridge line includes about 16 spur ridges extending to the east and west. It terminates in a gently sloping upland at the southern end, and on Little Mountain Overlook at the northern end, outside the mine boundary.

Most views from internal roads are limited to continuous woodlands with an occasional home or pond in the immediate foreground. The scenic integrity is above medium, but the landscape has only a little variety. At several places along the ridge, views from McIntire Road and Prewitt Road include regenerating clear-cut areas in the foreground and middleground. From these locations the scenic integrity of this landscape is low because the land appears scarred and discordant. In the Little Bywy Creek valley looking west from Salem-Bywy Road, the landscape has variety, harmony, and coherence. In this area the foreground is broad open pasture with occasional trees, and the middleground horizon is continuous woodland. A similar view of this area is seen from a hill top farm home on Tomnolan Road, outside the mine boundary. Views of smaller but similar pasturelands in the Middle Bywy Creek valley are seen by several homes overlooking the area from outside the eastern boundary, along Highway 9. Existing woodlands currently limit views of the mine site from homes and motorists along other areas of Highway 9, Pensacola Road, and some areas along Highway 415. Foreground views of open meadow and regrowth in clear-cut areas are seen from the remaining portion of Highway 415.

Chester community is located at the southern tip of the mine boundary, along Pensacola Road at the intersection with Highway 415. The community includes about 20 homes of various types, a commercial facility, a metal-sided warehouse, a church, and graveyard. Most of these features are clustered within an open grass area one-quarter mile square. The area is dotted with large shade trees, and is surrounded on three sides by mixed woodland, with open to pasture on the southern side.

The route for supplying electric power to the mine begins at the Ackerman substation and follows an existing powerline ROW north along Highway 9. It passes several homes and crosses rolling topography through open pasture, pine plantations, and deciduous woodland. The ROW is seen by traffic and residences along the highway. The route turns at the TVA transmission line and follows the TVA ROW west to terminate at the mine substation in the southeastern corner of the mine office area. Operations and maintenance personnel would occasionally see this section.

3.21.4 Generation Facility

The 390-acre generation facility site extends to the north and south, straddling a three-quarter mile section of Pensacola Road, about one-third mile west of Highway 9. Motorists have views of both areas, as do several homes located in the generation facility area along this section of road. The land is gently rolling with the highest area located north of Pensacola Road and east of McIntire Road. The lowest area is toward the southeast, along Besa Chitto Creek. From the road, about one-third of the foreground views

gure 4.4.1-1 Soils locations for proposed generation facility, mine, and EcoPlex.

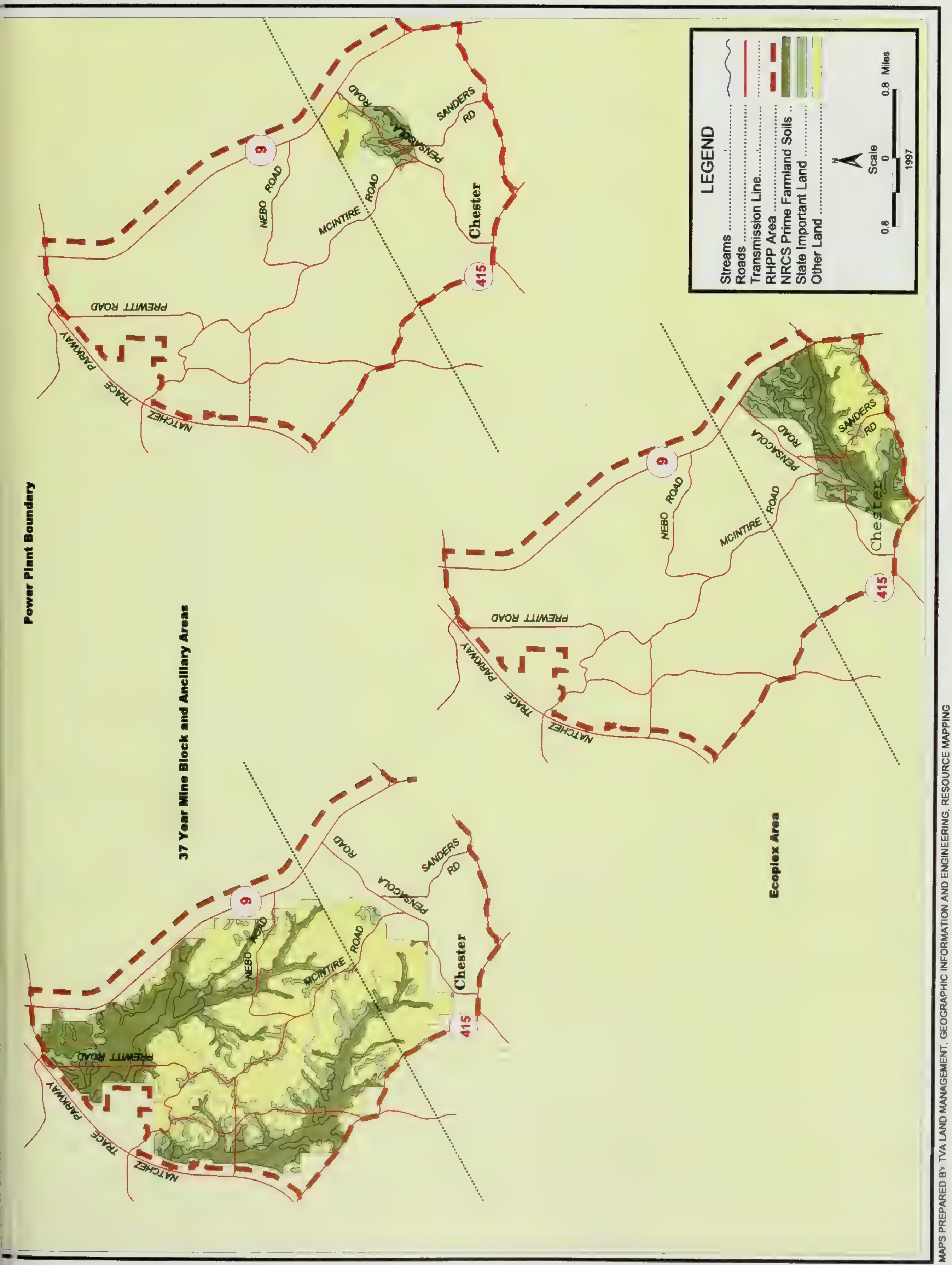


Table 4.4.1.1-1 Soils Impacted By Activity Areas Within the Red Hills Study Area

Map Unit and Description	Map Symbol	Mine		Generation Facility	
		Acres	%	Acres	%
Ariel silt loam, 0-2 % slope, well drained, occasionally flooded [a]	Ae	22.4	0.4	---	---
Arkabutla silt loam, 0-2 % slope, somewhat poorly drained, occasionally flooded [a]	Ak	40.2	0.7	---	---
Bude silt loam, 0-2 % slope, somewhat poorly drained [a]	Bu	59.9	1.0	1.3	0.3
Cascilla silt loam, 0-2 % slope, well drained, occasionally flooded [a]	Ca	159.6	2.8	---	---
Chenneby silt loam, 0-2 % slope, somewhat poorly drained, occasionally flooded [a]	Ce	593.0	10.3	---	---
*Guyton silt loam, 0-2 % slope, poorly drained, occasionally flooded [b]	Gu	57.0	1.0	---	---
Maben silt loam, 5-8 % slope, well drained, shaly clay subsoil [b]	MaC	27.8	0.5	---	---
Oaklimeter silt loam, 0-2 % slope, moderately well drained, occasionally flooded [a]	Oa	775.7	13.5	42.3	10.9
Ora loam, 5-8 % slope, moderately well drained, eroded [b]	OrC2	36.9	0.6	---	---
Ora loam, 8-12 % slope, moderately well drained, eroded [b]	OrD2	65.3	1.1	60.6	15.6
Pits-Udorthents complex, disturbed land	Pf	---	---	---	---
Providence silt loam, 2-5 % slope, moderately well drained, eroded [a]	PoB2	50.0	0.9	---	---
Providence silt loam, 5-8 % slope, moderately well drained, eroded [b]	PoC2	154.2	2.7	101.0	26.0
*Rosebloom silt loam, 0-2 % slope, poorly drained, occasionally flooded [b]	Ro	---	---	---	---
Smithdale-Ruston association, 5-35 % slope	SR	---	---	---	---
Smithdale-Sweatman association, 12-35 % slope	SS	1611.4	28.0	183.7	47.2
Sweatman silt loam, 5-8 % slope, well drained, shaly clay subsoil [b]	SwC	94.0	1.6	---	---
Sweatman fine sandy loam, 8-15 % slope, well drained, shaly clay subsoil	SwE	313.5	5.4	---	---
Sweatman fine sandy loam, 15-25 % slope, well drained, shaly clay subsoil	SwF	64.8	1.1	---	---
Sweatman-Providence association, 12-35 % slope	SX	1272.5	22.1	---	---
Tippah silt loam, 2-5 % slope, moderately well drained, eroded [a]	TaB2	133.3	2.3	---	---
Tippah silt loam, 5-8 % slope, moderately well drained, eroded [b]	TaC2	221.6	3.9	---	---
	TOTALS	5753.2	100.0	388.9	100.0
	Prime Farmland Soils	1834.2	31.9	43.6	11.2
	State Important Land	656.7	11.4	161.6	41.6
	Other Land	3262.3	56.7	183.7	47.2
	TOTALS	5753.2	100.0	388.9	100.0

[a] Prime Farmland Soils.

[b] State Important Land.

* Hydric soils.

Source: USDA-SCS, 1986. Soil Survey of Choctaw County, Mississippi.

are open pasture areas dotted with occasional trees, and the other two-thirds are dense evergreen regrowth on clear-cut tracts. Some agricultural cropland and more pastures are located to the south and are visible from Sanders Road.

Motorists along perimeter roads would have views of the generation facility site from a couple of locations where timber harvesting has removed roadside woodland. Southbound on Highway 9 just north of the TVA transmission line and looking southwest, the generation facility site would be in the near middleground across a maturing pine plantation. It would also be seen where the transmission line ROW crosses the road. Northbound on Highway 415 near the Lebanon Road intersection and looking northeast, the generation facility site would be about two miles in the distance across young clear-cut regrowth. At each location the road would be about the same elevation as generation facility site grade.

The 150-acre portion of the site identified for the initial ash management unit is a wooded valley located northeast of the generation facility. The elevation of the valley floor is about 60 ft below the generation facility site area. The steeply sloping area is primarily covered in deciduous forest, with an evergreen plantation to the west and a tract of evergreen forest along Pensacola Road. Motorists and three homes along Pensacola Road have foreground views of the woodland edge. A brief view is also available from traffic southbound on Highway 9, looking across the existing transmission line ROW.

3.21.5 Transmission Line and Natural Gas Pipeline

Transmission Line Corridor A

On the eastern end of this corridor, the Sturgis substation and existing transmission line are seen from County Line Road through narrow openings in mixed woodland. Between the Sturgis and Ackerman substations, the corridor crosses a rolling dissected topography covered with deciduous woodland and pine plantations, and is only seen at road crossings. The corridor is centered on the existing line with a 70 ft cleared ROW, and roughly parallels Highway 12 at a distance varying between 1,000 to 2,000 ft. From the highway, views of the ROW are obscured by dense woodland in the immediate foreground. The line is mounted on wood poles and crosses one paved and four gravel secondary roads. A church and graveyard are located in the corridor at Mt. Airy, Bethlehem, and Dido Roads. Churches at the first two locations are old style rural structures set on pillars, with wood siding and metal roofs. The third has asphalt shingles and a stone foundation. At each location, a narrow strip of trees limits most views of the existing line from church grounds. A bare soil sand pit covering about an acre is located under the line at Dido Road. The Ackerman substation is openly viewed by motorists where the study route crosses Highway 15, as are several existing lines from the substation that cross the road and turn other directions.

The corridor continues about 1,000 ft west through mixed woods, then turns north to Mabus Road centered on the old railroad ROW. This section follows a relatively level creek bottom, crossing pastures, patches of woodland, and a regenerating clear-cut area. Motorists and homes along Highway 15 can see most of the corridor up to the woods line just west of the ROW, and a couple of pasture openings beyond. From Highway 9 most views of the ROW are blocked by woods beginning beyond pastures in the middle foreground.

The corridor turns west centered on Mabus Road, where views are limited to immediate foreground of pine plantation on the northern side and clear-cut regrowth on the southern side. A home near Mabus Road intersection and several homes along the highway are located in the corridor where it crosses Highway 9. It continues west about 1,500 ft through clear-cut regrowth areas, then turns northwest. The corridor crosses Chaney Road where a farm home is located in the corridor, then continues through clear-cut regrowth, roughly parallel to Sanders Road. Views from these roads are limited by dense regrowth along both sides. At Besa Chitto Creek the corridor turns north, crossing crop and pasturelands to the generation facility switchyard. This last section is seen by motorists and a couple of homes on Pensacola Road, and motorists on Sanders Road.

Transmission Line Corridor B

The eastern end of this corridor also begins at Sturgis substation. Between the substation and Highway 15, the corridor crosses a rolling dissected topography covered with deciduous woodland and pine plantations, and is only seen at road crossings. The corridor crosses one paved and two gravel secondary roads, then Highway 15. At Bethlehem Road it crosses a young, ridge-top pine plantation with middleground views of maturing mixed forest across a clear-cut valley to the east. At Mt. Airy Road the corridor crosses deciduous woodland, and at Dido Road it crosses through maturing mixed forest. The corridor crosses through cut-over areas at Highway 15, with a thin strip of trees partially lining each side of the road. Across the highway, the corridor continues west through a relatively level area of clear-cut regrowth and joins corridor A where it turns on to Mabus Road.

Natural Gas Pipeline

The planned natural gas pipeline route falls within Corridor A of the transmission line study. The route begins where the existing natural gas pipeline crosses the railroad ROW, approximately 5,000 ft north of Highway 12 in Ackerman. The visual landscape affected by natural gas pipeline construction, from its beginning point northward, is the same as described for the transmission line corridor.

3.21.6 EcoPlex Site

Tentative location for the EcoPlex is an area generally southwest of the generation facility site between Pensacola and Chaney Roads (Figure 2-5.1). The land is gently rolling, with about a 90 ft area elevation drop from a high area along Sanders Road to Highway 415. Besa Chitto Creek drains through the area to the southwest. The area is viewed by motorists and residents looking south along portions of Pensacola Road, with pasture and a couple ponds in the immediate foreground and woodlands beyond. From the rest of Pensacola Road, Chaney Road, Sanders Road, Highways 9 and 415, views of the area are limited by an immediate foreground of various forest types and densities.

4. ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This chapter describes the environmental consequences which would likely occur from adoption of either the No Action Alternative or the preferred alternative. The alternative actions are described in Chapter 2, and the baseline conditions of each of the resources being evaluated are described in Chapter 3.

The following sections describe the direct, indirect, and cumulative impacts (also called effects) of the alternative actions on each of the resources described in Chapter 3. Direct impacts are those caused by the alternative actions and occurring in the same time and place. Indirect impacts (also called secondary impacts) are also caused by the alternative actions but may occur at a different time or place. Because it is often difficult to separate direct impacts from indirect impacts, they are combined in many of the following sections. Cumulative impacts are those resulting from the incremental impacts of TVA's actions "when added to other past, present, and reasonably foreseeable future actions" (CEQ Regulations, Section 1508.7), regardless of who causes the other actions. Acidic deposition and vegetation impacts are discussed in Section 4.22.2.

The proposed EcoPlex is being developed by Choctaw County and the state of Mississippi. Neither TVA nor COE is developing or funding development of the EcoPlex. Nor has either agency been asked to permit or otherwise approve the EcoPlex. However, because it would be developed in the same geographic area and at the same time as the RHPP, the potential impacts of the proposed EcoPlex are evaluated as a cumulative impact in Section 4.22.

4.2 Air Resources

This section presents an overview of the atmospheric emissions associated with the proposed action. Details on these emissions are presented in subsequent sections.

The RHPP includes a proposed 440-MW lignite-fueled generation facility and a proposed surface lignite mine. In association with the generation facility and mining operations, Choctaw County and the state of Mississippi propose to develop the Red Hills EcoPlex industrial park adjacent to the proposed generation facility.

Red Hills Generation Facility - The main sources of emissions would be the two circulating fluidized bed boilers burning lignite and wood waste; gas-fired auxiliary boilers; lignite, limestone, and wood waste receiving and handling; ash management; emergency generator and fire pump; and cooling towers.

Red Hills Lignite Mine - The main sources of emissions would be fugitive dust from removal of overburden, mining the lignite, and hauling the lignite from the mine to the receiving hopper. Other sources of emissions include exhaust emissions from mining equipment and haul trucks and from fuel storage tanks.

4.2.1 Action Alternative (Project as Proposed)

The potential operational air quality impacts associated with the proposed generation facility and lignite mine were evaluated using EPA-recommended air quality models. The approach and techniques utilized in the modeling analyses are described below. Primary air pollutants consist largely of SO_2, NOx, PM, and CO. Each of these emissions relate to one or more criteria pollutants for which the EPA has set National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. There are also Prevention of Significant Deterioration (PSD) increments for some of the pollutants. Air quality impacts from new sources locating in "clean-air" areas must not exceed the maximum allowable increases (PSD increments) that have been set for differing classifications of areas. The two relevant classifications are Class I areas (such as national parks and wilderness areas) for which Congress mandated extra protective measures and Class II areas (the rest of the nation) for which somewhat more lenient increments are allowed. The NAAQS (including the ozone and particulate matter NAAQS which became effective on September 16, 1997) and the Class I and Class II PSD increments are provided in Table 4.2.1-1.

As proposed, the project would result in emissions to the atmosphere of pollutants associated with combustion of fossil fuel, disturbance of earth (due to mining operations), and transportation of materials. These types of emissions are subject to regulation under the Clean Air Act, especially under those provisions designed to protect the existing air quality in areas that are in attainment with air quality standards. New sources of air pollutants constructed in attainment areas must perform a detailed analysis under PSD regulations to demonstrate that their emissions are as low as is practical and that their emissions would not lead to violations of air quality standards. Furthermore, these sources must demonstrate that their emissions would not lead to increases in pollutant levels above specified PSD increment levels (Table 4.2.1-1) which are a fraction of the air quality standard for a pollutant.

Emissions from this project would be sufficient to require the preparation of a PSD permit application. The following discussion of the impacts on the atmosphere due to emissions of the proposed generation facility and mine borrows heavily from that analysis. ("Application for New Source Review Under the PSD Regulations for the Red Hills Generation Facility" August 1997). Additional atmospheric dispersion modeling was performed to assess potential emissions that were not required to be addressed in the PSD permit application. This additional modeling was performed with the same model (ISCST3) and five-year period of meteorological data (1988 through 1992, Jackson, MS) used in the analyses performed to support the PSD permit application.

Table 4.2.1-1 National Ambient Air Quality Standards and Prevention of Significant Deterioration Increments (μg/m³)

Pollutant and Time Period	NAAQS[a] Primary	NAAQS[a] Secondary	PSD Class I Increment	PSD Class II Increment
Sulfur dioxide				
Annual arithmetic mean	80	none	2	20
24-hour average	365	none	5	91
3-hour average	-	1,300	25	512
Ozone				
8-hour average [b]	157	157	none	none
1-hour average	235	235	none	none
Nitrogen dioxide				
Annual arithmetic mean	100	100	2.5	25
Carbon monoxide				
8-hour average	10,000	10,000	none	none
1-hour average	40,000	40,000		
Particulate Matter				
PM_{10}				
Annual arithmetic mean	50	50	4	17
24-hour average	150	150	8	30
24-hour 99th percentile	150	150	none	none
$PM_{2.5}$				
Annual arithmetic mean	15	15	none	none
24-hour 98th percentile	65	65	none	none
Lead				
Quarterly arithmetic mean	1.5	-	none	none

[a] Unless otherwise noted, short-term standards (24 hours and less) are not to be exceeded more than once a year. Standards for periods longer than 24 hours are maximum permissible concentrations that are never to be exceeded.

[b] Based on the average of the 4th highest 8-hour concentration occurring during each of three consecutive years.

4.2.1.1 Construction Impacts

Generation Facility

Transient air pollutant emissions would occur throughout the construction phase of the generation facility. The amounts of emissions would depend on the nature of new construction required. Construction-related air quality impacts are primarily related to three kinds of activities:

- land clearing, site preparation, and vehicular traffic;
- open burning of cleared land debris; and
- operation of internal combustion engines.

Land clearing, site preparation, and vehicular traffic over unpaved roads and construction sites result in the emission of fugitive dust particulate matter (PM) during site preparation and active construction periods. The variation of these emissions and their resultant impacts in time and space are subject to both man-made (e.g., the type and frequency of these activities and pollution control measures) and natural (e.g., soil moisture, wind speed) factors. Overall, most fugitive dust emissions would be redeposited within construction site boundaries. The remaining PM fraction, smaller in mass but greater in number of particles, would be subject to longer-range transport. Best management practices for construction projects, such as operation of water trucks on unpaved roads, would be employed to minimize the offsite impacts from fugitive dust emissions.

Open burning of land debris, almost exclusively wood/vegetation in nature (e.g., trees, stumps, slash), would result in short-term emissions of PM, CO, NOx, CO_2, and trace amounts of volatile organic compounds (VOCs). All open burning activities would be conducted in compliance with applicable federal, state, and local regulations to minimize the likelihood of offsite air quality impacts.

Combustion of gasoline and diesel fuel by internal combustion engines (vehicles, generators, construction equipment, etc.) would generate local emissions of PM, CO, NOx, VOCs, and SO_2 throughout the site preparation and construction period. The total amount of these emissions would be small and would result in minimal offsite impacts.

Additional sources of VOCs include evaporative losses from onsite application of paint, coatings, adhesives, waterproofing, cleaning solvents, gasoline and diesel fuel storage, and refueling. These emissions would be relatively minor and are not expected to significantly influence offsite air quality.

The air quality impacts related to construction activities would be temporary in nature and are dependent on both man-made (e.g., intensity of activity, control measures) and natural factors (e.g., wind speed and direction, soil moisture). However, even under unusually adverse conditions, these emissions would have, at most, a minor, transient impact on offsite air quality and should not lead to an exceedance or violation of any applicable ambient air quality standard. Accordingly, the overall air quality impact of construction-related emissions would not be significant.

Mine

As described previously for the generation facility construction, transient air emissions would result from the construction of the mine and would have the same types and levels of impact on the atmosphere. Even though the mine construction would continue over several years, these emissions would be minimized using measures described in the fugitive dust control plan included in the mine permit application (MLMC 1997). Through the use of these BMPs, the emissions would have only a minor and transient impact on air quality and should not lead to violations of any air quality standard.

Transmission Line and Natural Gas Pipeline

Construction action associated with the transmission line and natural gas pipeline would include clearing and grading and open burning. Air quality impacts from construction of the transmission lines and natural gas pipeline would be similar to that from construction of the generation facility, and would not be significant.

4.2.1.2 Operational Impacts

Operational impacts are those associated with emissions to the atmosphere that occur as the result of the normal operation of a facility. The operational emissions of the generation facility and lignite mine are closely connected. Similarly, the operation of the generation facility and lignite mine lead to additional atmospheric emissions as the result of activity required to deliver materials to these facilities. For example, additional traffic during employee commuting results in increased vehicle exhaust emissions which would not occur if the generation facility and mine did not exist. The following presents a summary of the emissions associated directly with the proposed facilities, as well as the emissions associated with increased activity anticipated due to the presence of the facilities. Where possible, quantification of the atmospheric impact of these emissions is also presented.

Generation Facility Operation

Onsite Emissions – The combustion of fossil fuel, such as lignite, in the CFB boilers at the generation facility would be accompanied by relatively large emissions of pollutants to the atmosphere. Of primary concern for air quality in the area surrounding the site are the emissions of SO_2 and particulates. From a regional perspective, emissions of SO_2 and NOx are of concern because of the role they play in the formation of very fine particulates (aerosols) and ozone formation, respectively. Finally, CO and CO_2 emissions are important for the role they may play as greenhouse gases. A number of scientists think these gases are associated with increases in the earth's temperature. (See Chapter 3.)

A summary of the primary emissions from maximum operation of the generation facility while burning lignite only is presented in Table 4.2.1.2-1, with additional detail provided in Table 6-1 of the PSD permit application.

Table 4.2.1.2-1 Source Characteristics for RHGF (PSD Application)								
No	Stack Height (m)	Stack Dia. (m)	Exit Vel. (m/s)	Exit Temp. (°K)	SO_2 Emission Rate (g/s)	NOx Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	CO Emission Rate (g/s)
CFB and Auxiliary Boiler Stack								
1	106.7	7.9	18.3	405.4	156	186	9.63	128
Emergency Generator								
1	6.7	0.2	13.1	588.7	0.474	3.00	0.0538	0.798
Fire Pump								
1	4.6	0.2	3.4	588.7	0.0319	0.485	0.0340	0.105
Cooling Towers								
13*	18.3	3.0	7.6	295.4			1.45	

* Preliminary data will be revised.

Estimated ambient impacts due to generation facility emissions (as described in the PSD permit application) are presented in Table 4.2.1.2-2. These modeling results indicate that the atmospheric impacts of these emissions would not result in violations of any air quality standards or exceed the PSD increment levels.

Table 4.2.1.2-2 Summary of PSD Dispersion Modeling Performed for the RHGF and Other Sources [a]			
Pollutant	Averaging Period	Total Modeled Increment ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
SO_2	Annual	2.83	20
	24-hr	19.3	91
	3-hr	71.5	512
NO_2	Annual	0.79	25
PM_{10}	Annual	6.1	17
	24-hr	26.5	30

[a] Modeled for RHGF ambient impact as presented in the PSD permit application for the increment analysis.

<u>Visibility</u> – Combustion emissions from RHGF would lead to two general types of impacts on visibility. While plumes from the cooling tower may not effect air quality, their visual impacts are discussed in Section 4.21. One type of combustion emission impact is the general deterioration of visibility as the result of increased pollutant levels, particularly during the summer, and is often described as "regional haze." The other type is described as "plume blight" and occurs when the plume is visible against the sky or a terrain feature. To the extent that emissions from the generation facility contribute to the overall pollutant levels responsible for regional haze, these emissions would contribute to the haziness.

In the Southeast about 40% of the aerosols that are most responsible for regional haze are in the form of sulfate. Emissions from the generation facility, especially SO_2 emissions, would contribute to the overall level of pollutants that lead to regional haze. Due to the difficulty and complexity of quantifying haze,

no assessment of the impact is made. EPA has proposed regulations to address regional haze. These regulations would require states to ensure that visibility is not further degraded and to reduce existing impairment in Class I PSD areas.

Plume blight is the other form of visibility impact and is important to the overall experience of visitors to areas where visibility is expected to be good. Although current models are not capable of estimating the impact of emissions from a single plant on regional haze, models do exist for evaluating plume blight. VISCREEN is an EPA screening model designed to provide estimates of the visual impact of plumes. VISCREEN was applied to the emissions of the generation facility to determine the potential for visual impact at the nearest Class I area (Sipsey Wilderness Area), and at the Jeff Busby developed area and Little Mountain Overlook located on the nearby Natchez Trace Parkway.

The PSD application describes the application of the VISCREEN visibility screening model to determine if the plume from the generation facility would be visible at the Sipsey Wilderness Area, which is located in Alabama about 196 km northeast of the site. Although visibility analyses are normally performed only for Class I areas within 100 km of a proposed facility, the potential for impact on the Sipsey Wilderness Area was investigated since it is the nearest Class I area. VISCREEN considers primary particulate (PM_{10}) and nitrogen oxides (NOx) emissions, as well as the background visual range, distance to the nearest Class I area, wind speed, and stability class. VISCREEN was run assuming worst-case wind direction (towards the wilderness area), wind speed (1 m/s), and stability class (very stable [F]) conditions. Under these highly unusual conditions, VISCREEN predicted that the plume would not be visible to an observer in the Sipsey Wilderness Area. Screening models such as VISCREEN are designed to provide a margin of safety (i.e., they over-predict impact). Thus, the plume from the generation facility is not expected to be visible in the Sipsey Wilderness Area under any meteorological conditions.

Additional VISCREEN modeling was performed to determine the potential for plume blight affecting the visual experience of observers at the Little Mountain Overlook. The Overlook is located approximately 5.6 km northwest of the RHGF site. The results indicate that the generation facility plume would be visible to observers at the Overlook, particularly on days with the greatest visual range, occurring mostly on about 25 winter mornings per year. Due to the optical properties of NOx and fine particulates, on those occasions when the plume is visible it would have a slight reddish-brown color when viewed against a clear sky; however, the size of the plume, as well as the generation facility, would be small from this view. Furthermore, air quality regulations limit the opacity of the plume to less than 20%. Opacity is a measure of the attenuation of light passing through a plume; in effect, a person looking through a plume with 20% opacity would judge that background objects were 20% obscured. Combustion emissions from the stack were modeled using worst-case meteorological conditions. The modeling showed that no visible water vapor plumes would be formed.

<u>Hazardous Air Pollutants (HAP)</u> – A HAP analysis was performed to assess the potential health effects associated with the inhalation of air toxics potentially present in emissions from the proposed generation facility. Emission rates of hazardous air pollutants from the CFB boilers at maximum operation, while

burning lignite only (Appendix D-1), were estimated using procedures and data from the Electric Power Research Institute's (EPRI) PISCES test program (EPRI 1995).

SCREEN3, an EPA regulatory model (USEPA 1988), was used to estimate the maximum one-hour ambient concentration of these pollutants under worst-case meteorological conditions (Appendix D-2). Threshold concentration levels of each pollutant are also shown in Appendix D-2. Most of these thresholds are Threshold Limit Values - Time Weighted Averages (TLV-TWA) taken from guidance developed by the American Conference of Governmental Industrial Hygienists (ACGIH 1995). The TLV-TWA is the time weighted average concentration for a normal eight-hour work day and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. These ACGIH thresholds are not directly applicable to ambient exposures which tend to be for shorter durations. Since ACGIH thresholds were not available for all of the pollutants, some thresholds are from OSHA or NIOSH Current Intelligence Bulletin (CIB) 45; these are footnoted in Appendix D-2. The highest one-hour concentrations for each pollutant were compared to one-fortieth of the TLV-TWA; this approach is commonly used to convert occupational threshold levels to community safety threshold levels for comparison with one-hour concentrations (Appendix D-2). No threshold values were found for two pollutants, bis(2-Ethylhexyl)phthalate and propionaldehyde, so no comparison could be made. The maximum predicted one-hour concentrations were well below the threshold values for all of the pollutants, indicating that direct inhalation of hazardous air pollutants from the operation of the proposed generation facility would not cause significant adverse effects to human health in the surrounding area.

<u>Ozone (O_3)</u> – Emissions of NOx into the atmosphere can lead to the formation of O_3 through a complex series of photochemical reactions. O_3 concentrations in the area surrounding the generation facility had measured summertime maximum one- and eight-hour concentrations falling between 80 to 90 and 70 to 80 ppb, respectively. NOx emissions from the generation facility would result in formation of additional O_3, which would slightly increase these concentrations. This potential increase was quantified by performing photochemical modeling (See Appendix D-3). Estimated increases in O_3 concentrations typically fell in the 2 to 6 ppb range. These increases should not be used to draw conclusions regarding future nonattainment status of an area since nonattainment (for the eight-hour standard) would be based on measurements over a three-year period.

<u>Cooling Tower Impacts</u> – Cooling towers perform their function of removing heat by the evaporation of large quantities of water. Preliminary design for the generation facility indicates that 18 mechanical draft cooling towers would be used to provide sufficient cooling of the condenser circulating water to allow it to be recycled. This cooling would be accomplished by the evaporation of 4,100 gallons of water per minute. The resulting water vapor would be discharged from the cooling tower exhaust. Under certain meteorological conditions the water vapor in the cooling tower exhaust can condense to form a visible plume. The following discusses the meteorological conditions under which this can occur, the probability of occurrence, and potential environmental impacts.

Visible cooling tower plumes are most pronounced during cool, stable atmospheric conditions such as those occurring during the fall, especially during the early morning hours following clear, cool nights. These conditions are conducive to compact, slowly growing plumes extending downwind from the

cooling towers. As the plumes are transported downwind their temperature decreases, leading to condensation. This condensation, in turn, remains visible until the plume disperses enough to decrease the relative humidity to less than 100% within the plume. The formation and duration of these plumes is further enhanced during periods of high humidity since the atmosphere entrained into the plume is less effective at lowering the relative humidity within the plume. By contrast, meteorological conditions that favor the rapid dispersion of the plume–such as those occurring during summer days–disperse the plume so rapidly that there is no opportunity for the formation of a visible plume.

Visible plume formation under worst-case meteorological conditions was investigated with a cooling tower vapor plume model (Envirodyne 1976) These results are summarized in Table 4.2.1.2-3 for a range of atmospheric relative humidity.

Table 4.2.1.2-3 Visible Length of Cooling Tower Plume Under Worst-Case Conditions

Relative humidity of the atmosphere (%)	Length of visible plume (m)
50	14
80	29
90	59
95	318

Note: Based on a wind speed of 5 m/s and exit temperature of 3°C above ambient.

These results indicate that, under worst-case conditions, the cooling tower plume could be visible for up to 318 m from the cooling tower. The percentage of time under which the worst-case conditions occur is relatively low, and generally would be restricted to pre-dawn hours.

Meteorological conditions conducive to the formation of a visible cooling tower plume are associated with relatively low wind speeds, generally less than 5 m/s. Under these conditions the plume would remain elevated, and thus would not lead to fogging conditions on the ground. There is, however, a public road within a few hundred meters of the cooling towers (See Figure 2.2.1.3-1). Under high wind-speed conditions, the cooling tower plume could be brought to the ground by downwash on the downwind side of the cooling towers. These conditions occur rarely in central Mississippi. Furthermore, when they do occur, they are associated with meteorological conditions that are not conducive to the formation of a visible plume.

Offsite Emissions – Offsite emissions as a result of generation facility operation would occur away from the facility property. For example, emissions occurring as the result of delivering supplies and materials take place along the transportation route rather than on facility property. Limestone is integral to the combustion process of the facility and delivery of large quantities on a regular basis would be required. In the case of the proposed generation facility, limestone would likely be delivered by truck from quarries located in the region. Meeting the maximum limestone demand of the facility (as presented in the PSD application) would require, on average, delivery of a truckload of limestone every five minutes during the daytime work shift. This volume of truck traffic can be expected to lead to emissions of particulates from entrainment of loose material present on the road surface (fugitive emissions), as well as emissions from the diesel truck exhausts. A summary of these and other offsite emissions is presented in Tables 4.2.1.2-4 through 4.2.1.2-6. Tables 4.2.1.2-4 (based on delivery of 768,252 tons of limestone per year, at 25 tons per trip, over an estimated round-trip distance of 80 miles) and 4.2.1.2-5 present a summary of emissions associated with deliveries. Emission estimates for employee commuting are given in Table 4.2.1.2-6 (based on 39 full-time operations and maintenance employees at the generation facility, driving an average daily round-trip distance of 90 miles).

Table 4.2.1.2-4 Limestone Delivery to RHGF - Exhaust and Fugitive Dust Emissions (tpy)

Vehicle Exhaust[a]							Fugitive Dust[b]	
NOx	CO	NMHC	PM	SO_2	Pb	CO_2	TSP	PM_{10}
35.5	14.0	3.75	5.22	1.57	0.00027	5020	983	192

[a] Derived from Compilation of Air Pollutant Emission Factors Volume II: Mobile Sources (AP-42), 4th Edition, US EPA, Sept. 1985.

[b] Derived from Compilation of Air Pollutant Emission Factors Volume I: Stationary Point and Area Sources (AP-42), 5th Edition, Section 13.2.1, US EPA, Jan. 1995.

Table 4.2.1.2-5 Miscellaneous Delivery to RHGF - Exhaust and Fugitive Dust Emissions (tpy)

Vehicle Exhaust[a]							Fugitive Dust[b]	
NOx	CO	NMHC	PM	SO_2	Pb	CO_2	TSP	PM_{10}
0.416	0.165	0.0439	0.0611	0.0184	0.000003	58.8	1.64	0.32

[a] Derived from Compilation of Air Pollutant Emission Factors Volume II: Mobile Sources (AP-42), 4th Edition, US EPA, Sept. 1985.

[b] Derived from Compilation of Air Pollutant Emission Factors Volume I: Stationary Point and Area Sources (AP-42), 5th Edition, Section 13.2.1, US EPA, Jan. 1995.

Table 4.2.1.2-6 Employee Commute to RHGF - Exhaust and Fugitive Dust Emission (tpy)

Vehicle Exhaust[a]				Fugitive Dust[b]	
NOx	CO	HC	CO_2	TSP	PM_{10}
0.632	2.43	0.183	291	4.77	0.931

[a] Derived from Compilation of Air Pollutant Emission Factors Volume II: Mobile Sources (AP-42), 4th Edition, US EPA, Sept. 1985.

[b] Derived from Compilation of Air Pollutant Emission Factors Volume I: Stationary Point and Area Sources (AP-42), 5th Edition, Section 13.2.1, US EPA, Jan. 1995.

Mine

Onsite Emissions – Particulate emissions included in the PSD permit application that would be expected to be associated with mine operation are summarized in Table 4.2.1.2-7, with additional detail provided in Table 6-1 of the PSD permit application.

Table 4.2.1.2-7 Summary of Particulate Emissions (tpy) from Mine

Source Description	PM_{10}	TSP
Mine haul roads	5.2	17.7
Mine pit	80.3	280
Lignite Stack	5.22	37.2

These emissions are the result of mining operations such as digging and hauling, and reflect the application of BMPs for fugitive dust control (such as water trucks). Additional emissions would be expected from the exhausts of the heavy equipment used to perform these operations. Table 4.2.1.2-8 presents a summary of truck exhaust emissions resulting from the hauling of lignite outside the mine pit, while Table 4.2.1.2-9 presents a summary of exhaust emissions from equipment (dozers, shovel, front-end loader, scraper, grader, and lignite and overburden haul trucks) operating within the mine.

Table 4.2.1.2-8 Summary of Exhaust Emissions (tpy) From Lignite Hauling[a]

NOx	CO	NMHC	CH4	PM	SO_2	Pb	CO_2
0.644	0.574	0.149	0.00628	0.0105	0.299	0.00000518	95.5

[a] Derived from Compilation of Air Pollutant Emission Factors Volume II: Mobile Sources (AP-42), 4th Edition, US EPA, Sept. 1985.

Table 4.2.1.2-9 Summary of Exhaust Emissions (tpy) From Mine Equipment[a]

NOx	CO	HC	PM	SO_2	Pb	CO_2
49.2	22.1	3.51	2.31	5.62	0.000219	4030

[a] Derived from Compilation of Air Pollutant Emission Factors Volume II: Mobile Sources (AP-42), 4th Edition, US EPA, Sept. 1985.

A summary of the results from the PSD modeling for TSP and PM_{10} impacts is presented in Table 4.2.1.2-10. These results indicate that the ambient impacts of the TSP and PM_{10} emissions from the mine, in combination with the emissions from the proposed generation facility, would not exceed the PSD increments or the NAAQS.

Table 4.2.1.2-10 Summary of PSD Modeling for TSP and PM_{10} Impacts			
Pollutant	Sources	Averaging Time (NAAQS, $\mu g/m^3$)	Estimated Impact ($\mu g/m^3$)
TSP	RHGF	24-hr; highest, second highest (150)	45.0
TSP	RHGF, RHLM, and background sources	24-hr; highest, second highest (150)	81.7
TSP	RHGF, RHLM, background sources, and background ambient concentration	24-hr; highest, second highest (150)	147.7
PM_{10}	RHGF	Annual (50)	5.8
PM_{10}	RHGF, RHLM, and background sources	Annual (50)	6.1
PM_{10}	RHGF, RHLM, background sources, and background ambient concentration	Annual (50)	18.1
PM_{10}	RHGF	24-hr; highest 6th highest over 5 years (150)	23.6
PM_{10}	RHGF, RHLM, and background sources	24-hr; highest 6th highest over 5 years (150)	24.4
PM_{10}	RHGF, RHLM, background sources, and background ambient concentration	24-hr; highest 6th highest over 5 years (150)	62.4

Offsite Emissions – Offsite emissions associated with the lignite mine would be primarily from vehicle exhaust and fugitive dust due to deliveries and employee commuting. An estimate of these emissions is presented in Tables 4.2.1.2-11 and 4.2.1.2-12. Delivery estimates are based on 378 monthly deliveries over an average round-trip distance of 60 miles; commute estimates are based on 139 employees traveling a daily average round-trip distance of 90 miles. These emissions are both small in quantity and distributed over a large area, therefore, there would not be any adverse local air quality impacts.

Table 4.2.1.2-11 Miscellaneous Delivery to RHLM - Exhaust and Fugitive Dust Emissions (tpy)								
Vehicle Exhaust[a]							Fugitive Dust[b]	
NOx	CO	NMHC	PM	SO_2	Pb	CO_2	TSP	PM_{10}
3.93	1.55	0.415	0.578	0.174	0.00003	556	15.5	3.02

[a] Derived from Compilation of Air Pollutant Emission Factors Volume II: Mobile Sources (AP-42), 4th Edition, US EPA, Sept. 1985.

[b] Derived from Compilation of Air Pollutant Emission Factors Volume I: Stationary Point and Area Sources (AP-42), 5th Edition, Section 13.2.1, US EPA, Jan. 1995.

Table 4.2.1.2-12 Employee Commute to RHLM-Exhaust and Fugitive Dust Emissions (tpy)					
Vehicle Exhaust[a]				Fugitive Dust[b]	
NOx	CO	HC	CO_2	TSP	PM_{10}
2.25	8.67	0.653	1040	17.0	3.32

[a] Derived from Compilation of Air Pollutant Emission Factors Volume II: Mobile Sources (AP-42), 4th Edition, US EPA, Sept. 1985.

[b] Derived from Compilation of Air Pollutant Emission Factors Volume I: Stationary Point and Area Sources (AP-42), 5th Edition, Section 13.2.1, US EPA, Jan. 1995.

4.2.1.3 Combined Impacts of Generation Facility and Lignite Mine

Onsite Emissions – Emissions associated with the operation of the RHGF and RHLM, in combination with emissions from other nearby sources would combine to create an overall impact on air quality. These combined impacts are summarized in Table 4.2.1.3-1. These results indicate that the combined impacts of the RHGF and RHLM emissions would not exceed air quality standards.

Table 4.2.1.3-1 Summary of PSD Dispersion Modeling Performed for the RHGF and Background Sources[a]		
Pollutant	Averaging Period (NAAQS, $\mu g/m^3$)	Total Modeled Concentration ($\mu g/m^3$)
SO_2	Annual(80)	8.74
	24-hr(365)	112.4
	3-hr(1300)	221.8
NO_2	Annual(100)	0.79
TSP[b]	24-hr(150)	147.7
PM_{10}	Annual(50)	18.1
	24-hr(150)	62.4
CO	8-hr(10,000)	82.9
	1-hr(40,000)	339.6

[a] Total modeled concentration as presented in the PSD permit application for the RHGF. Total includes existing background concentration.

[b] Mississippi standard.

Offsite Emissions – Offsite emissions for the RHGF and RHLM are described in the above sections for the two facilities. These emissions are primarily the result of vehicle traffic, such as delivery trucks and commuting. Emission estimates for this activity are presented above. Since similar emissions would be associated with development and operation of the EcoPlex, the air quality impacts are presented in Section 4.22.2 Cumulative Impacts.

4.2.2 No Action Alternative

Under the No Action Alternative, air quality would likely be unchanged from its present condition. Additional air pollution would result from routine area development (e.g., industrial, commercial or housing development). Most likely, this growth would be slow and incremental, and impacts on air

quality would likely be insignificant. However, if the generation facility and lignite mine are developed separately from TVA, the impacts described in the proposed action would most likely still occur.

4.2.3 New Regulations

EPA revised the ozone and fine particulate air quality standards in July 1997. As these revised standards are implemented, operation of a fossil-fuel generation facility could be affected. The revised standards should prove more stringent, and consequently more difficult to achieve and maintain, than the previous standards; and it is possible that a number of nearby areas could become nonattainment even if air quality does not decline.

Three consecutive years of monitoring data and, in the case of the particulate matter standard, new sampling instrumentation are needed before the area's ability to attain the revised standards can be established. Although the EPA schedule for attainment status designation is several years in the future, there is a potential impact on RHPP and the surrounding area due to the revised ozone and particulate matter standards. An assessment of historical ozone and particulate matter monitoring data across the Tennessee Valley region indicates a potential for nonattainment for both these standards across the Southeast. The impact of the revised ozone and particulate matter standards could place additional regulatory scrutiny on large NOx and SO_2 emissions sources, respectively.

Although the specific impact of the proposed facility on future attainment status with the NAAQS is not known, there could be consequences for the facility. For example:

- Although the Red Hills area currently meets one-hour ozone and PM_{10} particulate matter standards, historical ozone and particulate matter data collected in the Southeastern States indicate that areas currently in attainment could become nonattainment under the revised standards.
- If an area near Red Hills is designated nonattainment for ozone (September 2000), existing sources may have to reduce NOx emissions and new NOx sources could be required to obtain NOx emission offsets from other NOx sources located in the same airshed to receive air permits.
- If an area near Red Hills is designated nonattainment for $PM_{2.5}$ (September 2005), existing sources may have to reduce SO_2 emissions and new SO_2 sources could be required to obtain $PM_{2.5}/SO_2$ emission offsets from other $PM_{2.5}/SO_2$ sources in the same airshed to receive air permits.

EPA has announced its intent to address ozone and particulate matter nonattainment, and regional haze concerns, with a regional management approach to reduce NOx and SO_2 emissions (particularly from fossil-fueled utility boilers) which includes revisions of new source performance standards.

4.3 Geology

4.3.1 Action Alternative (Project as Proposed)

4.3.1.1 Construction Impacts

Generation Facility

Construction activities associated with the facility would have no adverse impact on local geologic mineral resources other than to preclude use of any geologic resources that might exist in project construction areas. As noted in Section 3.3.4, the only economically-significant mineral resource that might exist in the project area is construction sand. However, the extent and value of such sand deposits are unknown. In any case, construction-grade sand is widely available in Choctaw and surrounding counties, and the loss of sand deposits in the project area would be insignificant.

The earthquake hazard to ordinary buildings at RHPP can be adequately addressed through adherence to the seismic provisions of national model building codes. Special structures that house hazardous processes or sensitive equipment may require additional considerations. Transport of hazardous substances through underground or aboveground piping may also require special designs to address seismic hazards. The chance of significantly altering the natural seismic activity of the area through construction of the RHPP is too remote to warrant any changes in construction.

Mine

Construction activities associated with the mine would have no adverse impact on local geological mineral resources, other than to preclude the use of construction sand in the immediate area. However, the abundance of construction sand in the region would render the loss of any sand deposits at the mine as insignificant. There are no impacts expected on or from seismicity.

Transmission Line and Natural Gas Pipeline

Construction activities associated with the transmission line and natural gas pipeline would have no adverse impact on local geologic mineral resources, due to the small acreage involved. There are no impacts expected on or from seismicity.

4.3.1.2 Operational Impacts

Generation Facility

Operation of the facility would have an insignificant impact on sand resources that might exist within the project area other than to preclude their development. Construction sand is widely available throughout Choctaw County and surrounding areas, therefore, the loss of any sand deposits that may exist in the project area is considered insignificant. There are no impacts expected on or from seismicity.

Mine

Loss of sand deposits in the project area would be insignificant. Removal of lignite deposits within the 3,800-acre area to be excavated and mined represents only a small fraction of the total area over which mineable lignite is present in northeastern Mississippi, and would therefore be insignificant. Overburden removal would cause a significant change to current stratigraphy. However, backfilling and grading to replace the overburden would be contemporaneous with mining. Removal of the two bottom lignite seams is not currently planned. After reclamation, it is unlikely that the lignite deposits could be economically recovered in the future. The top four feet of selected overburden would be non-acid forming, non-toxic forming, and non-combustible materials. The use of selected overburden materials is expected to create an equal to or better plant growth medium than the existing native soils based on a comparison of the physical and chemical data. The postmining topography would approximate the original topography and in some cases create more gentle slopes. No impacts are expected on or from seismicity.

Transmission Line and Natural Gas Pipeline

No impacts from operation and maintenance of the transmission lines and natural gas pipline are expected on or from local geological mineral resources or seismicity.

4.3.1.3 Combined Impacts of Generation Facility and Mine

The principal geologic impacts of the generation facility and mine relate to future preclusion of the development of mineral resources, such as construction sand, that may be present at the project site and to the removal of all economically-significant lignite deposits from the mine area. These adverse impacts are considered insignificant because both of these geologic resources are widely available in Choctaw County and northeastern Mississippi.

Under some circumstances, human activities can change the ambient seismicity of an area. Four types of human activities are known to have the ability to change seismicity levels and patterns: (1) the creation of large reservoirs, (2) large underground explosions, e.g., nuclear tests, (3) the injection, or withdrawal, of underground fluids, and (4) the excavation of mines (Gough 1978). These activities can induce earthquakes ranging in size from microearthquakes to earthquakes with m_b magnitudes of 6 or slightly greater (Yeats et al. 1996).

Activities (1) and (2) above would not result from RHPP activities, and do not need to be considered in assessing the potential for induced earthquakes. No underground fluid injection, activity (3), is planned as part of the RHPP operations. Long-term withdrawal of water would occur at the site from the Massive Sands of the Tuscaloosa Aquifer System. Three wells would pump water from this aquifer at depths of about 3,000 ft. Average annual pumping rates are expected to be 6.6 mgd per well. However, removal of similar large quantities of water (6.70 mgd) from the same aquifer in Lowndes County, Mississippi, about 42 miles east of the site, has not produced any noticeable changes in seismicity. Therefore, withdrawal of water from underground aquifers is not expected to induce earthquakes at this site.

Excavation of mines, especially underground mining, can alter the natural seismicity of an area (Williams and Arabasz 1989, Bollinger 1989, Hasegawa et al. 1989, Long and Copeland 1989). It is unusual for surface mining to alter background seismicity, but there are some known or suspected cases of this occurring (Pomeroy et al. 1976, Chapman et al. 1994, Jones et al. 1985, Scharnberger 1994). The likelihood of mining-induced earthquakes at the RHPP site is reduced because the areas that are mined would be refilled. Excavation would only be a transitory effect. Therefore, while excavation at the site cannot be eliminated as a possible cause of induced earthquakes, it is not likely to occur.

4.3.2 No Action Alternative

Under the no action alternative, the population in the project vicinity would probably not change substantially in the foreseeable future. Therefore, the availability of geologic resources in the No Action Alternative would remain essentially unchanged. It is possible, however, that the proposed project would occur even if TVA should decide to take no action (i.e., decide not to buy the electricity generated by the facility). This could occur if another buyer were found for the output of the facility. In that event, the impacts would be similar to those described in this EIS for the action alternative.

4.4 Soils

4.4.1 Action Alternative (Project as Proposed)

The potential impacts on soils are expected to be both temporary and permanent. Conversion of farmland and prime farmland soils to industrial and other nonagricultural uses must be assessed under the Federal Farmland Protection Policy Act (see Section 3.4). The amounts and consequences of Natural Resource Conservation Service (NRCS) prime farmland soils that would be impacted by the generation facility, lignite mine, and utility corridors are discussed in this section. The description and identification of prime farmland soils occurring within the entire project area and proposed utility corridors is presented in Section 3.4.

4.4.1.1 Construction Impacts

Generation Facility

Construction of the RHGF and its ancillary facilities would adversely affect soils on about 390 acres, of which 11% are classified as NRCS prime farmland soils, 42% are State Important Land, and 47% are Other Land (see Figure 4.4.1-1 and Table 4.4.1-1). The area within the generation facility boundary fence would impact about 44 acres of Besa Chitto Creek bottomland soils (Oaklimeter and Bude series) and 346 acres of gently sloping to hilly upland soils (Ora, Providence, and Smithdale-Sweatman series).

Land clearing and soil disturbance prior to construction of the generation facility and its ancillary facilities would have short-term adverse impacts associated with accelerated erosion, especially on soils with steep slopes. Erosion losses due to construction effects can largely be mitigated by adopting erosion control BMPs, such as installation of fabric filter silt fences, appropriate placement of hay bales, establishment of cover crops, and use of run-off settling sumps. Localized soil compaction would also occur in association with ash management unit construction activities. In the long-term, soils occurring within the generation facility site would be converted for the life of the project, from agricultural and forestry to industrial uses.

Mine

Mine construction activities would include mine facilities, erection sites, access amd lignite transport roads, surface water control structures, and stockpile sites. These construction activities would create short-term adverse effects from land disturbance on 1,900 acres by accelerating soil erosion, especially on soils of steeper slopes. Erosion losses resulting from ancillary facilities construction would largely be mitigated by using BMPs such as installation of fabric filter silt fences and hay bales, quick establishment of grass groundcover, and use of diversion structures and settling sumps. Another potential impact on soils that could result from these activities is localized, temporary soil compaction. However, these facilities could be dismantled and reclaimed, if required after mining, thus eliminating any compaction.

Transmission Line and Natural Gas Pipeline

Construction of the proposed TVA transmission lines within either of the two alternative corridors (A or B) described in Section 2.2.3 would have mostly short-term impacts on soils. As indicated in Section 3.4.4, alternative Corridor A contains about 335 acres of prime farmland soils, and Corridor B has about 196 acres classified as prime farmland soils. Construction activities within these corridors would create localized short-term adverse effects from accelerated soil erosion. Revegetation practices as mentioned and BMPs would mitigate most of these impacts. The other possible adverse impact to soils from construction of new transmission lines is localized soil compaction from heavy equipment used in the installation of towers and lines.

The potential impacts to about 71 acres of hydric soils (Guyton series) in Corridor A are discussed in Section 4.8, Wetlands. Any soils presently used for agricultural purposes would probably be maintained in this land use after installation of the transmission lines.

Construction of a proposed natural gas pipeline (discussed in Section 2.2.4) would have short-term adverse impacts on soils by creating accelerated soil erosion on areas cleared and excavated. This should be a short-term impact if appropriate soil erosion control, revegetation, and other BMPs are adopted. Some localized soil compaction might also occur from equipment used during natural gas pipeline installation. Within the proposed natural gas pipeline corridor, there are about 215 acres of prime farmland soils (see Section 3.4.4). With appropriate fertilizer and liming practices, the soil productivity of areas disturbed by natural gas pipeline installation within this utility corridor should be as high as before construction activities. Impacts on about 14 acres of hydric soils (Guyton series) occurring within the natural gas pipeline corridor are discussed in Section 4.8, Wetlands.

4.4.1.2 Operational Impacts

Generation Facility

Impacts on soils from operation of the generation facility should be minimal. The significant adverse impact of the facility on soils which occur in the designated ash management unit has been covered in Section 4.4.1.1. There would be additional operational impacts on soils if additional ash managements units were required during the life of the generation facility. Operation of the facility would have the potential for oil and grease runoff from parking lots, access roads, and haul roads to impact adjacent soils. This can be mitigated by impounding runoff before it reaches downslope offsite soils. The various chemical storage facilities involved in the operation of the facility could also have potential impacts on adjacent soils. Possible contamination of soils due to accidental spills from fuel, lubricating oil, acid, caustic fluids, and other chemical storage facilities would be minimized by enclosing these facilities within curbed or diked areas. The measures contained in the Spill Prevention Control and Countermeasure (SPCC) Plan would be utilized whenever such an event occurred. Therefore, any impacts to soils would be insignificant.

Mine

Proposed mining activities have the potential to disturb about 5,700 acres of land between the years 1998 and 2034 (37-year mining activity area, see Table 4.4.1.1-1 and Figure 4.4.1.1-1). This includes about 3,800 acres to be disturbed by mining activities for the excavation and removal of lignite, and about 1,900 acres which would be disturbed by mine construction activities. About 32% of the total project area is prime farmland soils and would be impacted by mine-related activities. These prime farmland soils are classified as Ariel, Arkabutla, Bude, Cascilla, Chenneby, Oaklimeter, Providence, and Tippah soil series (Figure 4.4.1.1-1 and Table 4.4.1.1-1). Most of these prime farmland soils occur within the floodplains of Middle Bywy Creek and Little Bywy Creek. As indicated for the five-year mine permit application (page 2539-3), none of these prime farmland soils are classified as "historical cropland" as defined by Mississippi Surface Mining and Reclamation Regulations. The potential adverse impacts from conversion of prime farmland soils from agricultural to industrial uses by mining activities are

considered insignificant. In addition to soil erosion control, stockpiled overburden would need appropriate management procedures to ensure against unacceptable amounts of acidity in leachate and run-off water (particularly for unoxidized materials). About 57 acres of hydric soils (poorly drained Guyton series, silt loam) would be adversely impacted within the 37-year mining area (Table 4.4.1.1-1). These impacts are discussed in Section 4.8, Wetlands.

The approximately 3,800 acres proposed to be excavated for removal of lignite would be required to be reclaimed to a soil productivity level and slope that is equal to, or more favorable than, the premining condition. The relatively thin surface (A) horizon that presently exists on most of the upland soils in the proposed mine area would not provide sufficient amounts of topsoil for surface placement on all of the reclaimed land. The proposed land reclamation plan provides for the substitution of topsoil with a selected overburden material which contains pedogenic A and B soil horizons mixed with underlying oxidized materials. Based on the chemical and physical characteristics of these upper and lower oxidized materials (see Appendix C-9), and with recommended fertilization and liming, it would be possible to reclaim soils impacted by lignite mining to productivity levels equal to or greater than those of premining soils. Whether these long-term impacts on productivity are adverse or beneficial depends upon reclamation. Based on laboratory data, potential toxicities from heavy metals and acid-forming pyritic sulfur should not be a problem with any of the oxidized overburden materials (see Appendix C-10) for reestablishing vegetative cover.

The proposed land reclamation procedure involves placement of a suitable mixture of selected overburden material at a minimum rooting depth of four feet, and graded and leveled to original contour or lower slopes. After replacement, the selected overburden material would be sampled and analyzed (to a depth of four feet) for chemical and physical parameters such as nutrient deficiencies, presence of acid-forming or toxic-forming materials, combustible materials, and soil compaction. The truck/shovel fleet would minimize compaction during reclamation, but a ripper would be used where necessary. Such soil productivity problems would need to be corrected prior to re-establishing a permanent vegetative cover. A critical need would be to determine the appropriate fertilizer (nitrogen, phosphorus, potassium, and possibly micronutrients) and liming amendments necessary. For most grass and legume species, the reclaimed surface soil (six-inch depth) should be maintained at about pH 6.0. For forestry, the pH should be slightly acidic. The plant rooting zone should also contain a balanced mixture of sand, silt, and clay fractions to ensure an adequate water holding capacity. Measures should also be taken to prepare a restored soil which has a bulk density that is within the range of the original soils (1.35 to 1.55 g/cm^3, see Appendix C-7), unless a designated land use requires otherwise.

Soil erosion control practices described in Section 4.4.1.1 would minimize erosion losses. For establishing immediate or temporary vegetative cover, a properly prepared seedbed would be planted to warm-season grasses (such as common bermuda) or cool-season grasses (such as tall fescue, ryegrass, wheat) depending on seasonal needs. As the vegetative cover becomes more permanent, perennial legumes, such as clovers, lespedeza, and other locally-suited species, should be included for maintaining long-term soil productivity, especially on areas designated for agricultural production. Based on the premining land use and/or landowner preferences, loblolly pine or other forest seedlings would be

planted on reclaimed land designated for forestry, which would be the predominant postmining land use (see Sections 3.12 and 4.12).

As discussed in Section 4.4.1.1, about 32% of the 37-year mining block and ancillary area is classified as prime farmland soils. Most of this acreage would be disturbed by overburden removal during extraction of the lignite. Although the morphology and composition of these prime farmland soils would be an irreversible and permanent impact, their lost soil productivity could possibly be fully replaced by comparable acreage of reclaimed land. The amount of "historical cropland" on prime farmland soils, as defined by Mississippi Surface Mining and Reclamation Regulations, is nonexistent within the proposed five-year mining area. The adverse impact on agricultural crop production created by mining of lignite on prime farmland soils would be insignificant.

Transmission Line and Natural Gas Pipeline

The operational phase of proposed new electrical transmission lines and the natural gas pipeline should result in no impact to very minimal impact on soils. The short-term adverse impacts on soil erosion discussed for the construction phase (Section 4.4.1.1) would soon be mitigated by re-establishment of vegetative cover and the use of other BMPs. Continued traffic by maintenance vehicles along these utility corridors could cause localized soil compaction, however, this would not be a significant impact.

4.4.1.3 Combined Impacts of Generation Facility and Mine

Construction and operation of the proposed generation facility and lignite mine represent a combined commitment of about 6,200 acres of soil resources (Table 4.4.1-1 and Figure 4.4.1-1). About 72% of this acreage is classified as gently sloping to hilly upland soils, and 28% is classified as bottomland soils. The total acreage of prime farmland soils (NRCS classification) occurring within the generation facility and mine areas is about 1,878 acres. Since these activities would remove the prime farmland classification, impacts could represent an irretrievable commitment of soil resources. However, the potential exists in the mine area to create additional prime farmland soils using the selected overburden material.

The total project area of about 9,300 acres (including the EcoPlex industrial park) was used to prepare the Farmland Conversion Impact Rating (see Section 3.4.3). Based on the 2,765 acres of prime farmland soils, the total point score of *104* is well below the threshold *160* point score that is suggested as the level where additional project alternatives be considered (USDA-SCS 1984).

4.4.2 No Action Alternative

Under the No Action Alternative, environmental impacts on soils would remain as they are under current and future uncertain use. However, TVA's decision to not purchase power from the project would not preclude its eventual development if the power and/or lignite is purchased by another entity. Therefore, impacts could be the same as those described in this EIS.

4.5 Groundwater Resources

4.5.1 Action Alternative (Project as Proposed)

4.5.1.1 Construction Impacts

Generation Facility

Generation facility construction activities potentially affecting groundwater resources would include construction groundwater use; foundation dewatering; and excavation and grading associated with the generation facility structures, roads, well-field pipelines, transmission lines, and ash management units.

Groundwater would be used intermittently during the construction phase of the project to facilitate drilling of the three deep production wells and for other construction purposes. A rig-supply well developed in the Lower Wilcox Aquifer would be constructed adjacent to each production well site. Pumpage from Rig Supply Well 1 would be expected to average approximately 0.016 mgd, whereas Wells 2 and 3 would each use approximately 0.09 mgd. Short-term pumping rates of up to 100 gpm would be anticipated from each well. The effect of construction pumpage would be limited to insignificant declines in the local potentiometric levels in the Lower Wilcox Aquifer. Predicted drawdowns beyond a distance of 0.5 mile from each supply well are estimated to be on the order of one foot or less for both peak short-term usage and long-term average pumpage. None of the private water supply wells in the project locality are expected to be adversely affected.

Preliminary geotechnical investigations at the generation facility site (Burns & McDonnell 1997) indicate groundwater control for foundation construction would likely require only passive methods (e.g., sump pits and trenches) for excavations above the Lower Wilcox Aquifer. Foundation excavations below the top of the Lower Wilcox Aquifer (at approximate elevation 540 ft in the facility area) could require short-term use of active dewatering methods (e.g., well points) to control groundwater. Due to the localized short-term nature of any foundation dewatering that could be required, no adverse construction dewatering impacts are anticipated.

Excavation and grading associated with construction of the generation facility and ancillary facilities would result in permanent displacement of relatively shallow Wilcox sediments, most of which lie above the water table. The long-term impact of these construction activities on local groundwater resources would be negligible given the limited depth and area of disturbance.

Mine

Mine construction activities potentially affecting groundwater resources would include construction groundwater use, as well as excavation and grading associated with the mine office and shop facilities, surface water control impoundments, conveyor systems, and haul roads.

Construction of the mining facilities would require intermittent use of groundwater from a single well completed in the Lower Wilcox Aquifer located near the mine office and shop facilities in the southeastern corner of the proposed mine permit area. The average withdrawal rate during the construction period would be approximately 0.01 mgd with peak short-term pumpage of up to 100 gpm. The effect of construction pumpage would be limited to insignificant declines in the local potentiometric levels in the Lower Wilcox Aquifer. Predicted drawdowns beyond a distance of 0.5 mile from the supply well are estimated to be on the order of one foot or less for both peak short-term usage and long-term average pumpage. None of the private water supply wells in the project locality are expected to be adversely affected.

Excavation and grading associated with construction of the mining facilities would result in permanent displacement of relatively shallow Wilcox sediments, most of which lie above the water table. The long-term impact of these construction activities on local groundwater resources would be negligible given the limited depth and area of disturbance.

Transmission Line and Natural Gas Pipeline

Transmission line and natural gas pipeline construction activities (e.g., clearing, grubbing, and shallow excavation for tower foundations and road construction) are not expected to have any adverse impacts on groundwater resources or users.

4.5.1.2 Operational Impacts

Generation Facility

Groundwater Use – Cooling water for the generation facility would be obtained from a well-field developed in the Tuscaloosa Aquifer System (TAS). The expected long-term average plant makeup-water requirement of 6.33 mgd would be derived from three wells spaced at least 2,500 ft apart across the project site (see Figure 3.5.3-1). Wells would be screened primarily in the Massive Sand Aquifer of the TAS at depths of about 3,000 ft. Well-field operation over the life of the facility is expected to reduce the potentiometric surfaces in the Massive Sand Aquifer and, to a lesser extent, the aquifers which lie above and below the Massive Sand Aquifer.

To quantify the potential impacts resulting from generation facility groundwater use, a numerical groundwater flow model was developed encompassing an approximate 40,000-mile^2 region in northern Mississippi surrounding the project site. The model was used to simulate the effects of pumpage over the expected 30-yr generation facility life on all major regional aquifers including, in ascending stratigraphic order: the Lower Cretaceous Aquifer; the Massive Sand, Coker, and Gordo aquifers of the TAS; Eutaw-McShan Aquifer; and the Lower Wilcox Aquifer (see Section 3.3.2). The following specific issues were examined using the model: (1) the magnitude of the potentiometric surface decline in the regional aquifers and its probable impact on existing groundwater users, (2) the potential for pumping-induced saltwater encroachment from the Lower Cretaceous Aquifer as well as from down-dip

regions within the Massive Sand Aquifer, and (3) the potential for land subsidence due to well-field pumpage. A description of the groundwater model is given in Appendix D-4.

Figure 4.5-1 delineates the potentiometric surface drawdowns in each of the TAS aquifers after 30 yrs of continuous pumping. Overall, the projected potentiometric declines in the TAS aquifers would be small but widespread due to their highly transmissive nature. Drawdowns would be the greatest in the Massive Sand Aquifer because the well-field would be developed primarily in this aquifer. As shown on Figure D-4.1, the nearest permitted wells completed in the Massive Sand Aquifer are be located 40 miles or more from the project site in Lowndes, Lauderdale, and Noxubee Counties. Predicted potentiometric drawdowns in the vicinity of these wells would range from 12 to 14 ft. Maximum drawdown in the closest permitted Coker well located approximately 9 miles northeast of the site would be less than 15 ft, while drawdowns in the remaining Coker wells in the region are estimated to range from 6 to 12 ft. Estimated drawdowns in permitted wells completed in the Gordo aquifer in the site region would be less than five feet. In general, the magnitude of the predicted drawdowns in the TAS aquifers would result in small increases in pumping lifts and associated costs to existing users, but would not require well pump modifications. The potential long-term effects of plant groundwater use on existing and future TAS users are considered insignificant.

Predicted drawdowns in the Eutaw-McShan and Lower Wilcox Aquifers which lie above the TAS would be negligibly small, i.e., less than five feet in the Eutaw-McShan and less than 0.001 ft in the Lower Wilcox (see Figure 4.5-2). Potentiometric declines in the underlying Lower Cretaceous Aquifer would be on the order of 10 ft throughout the modeled region. There are no existing Lower Cretaceous Aquifer users in the site region due to its poor water quality and extreme depth. The potential effects of the generation facility groundwater withdrawals from the TAS, on existing and future users of the aquifers above and below the TAS, are considered insignificant. Further discussion of drawdown predictions in both the pumped and unpumped aquifers is presented in Appendix D-4.

Figure 4.5-1 Predicted drawdown in TAS aquifers at end of 30-year pumping simulation.

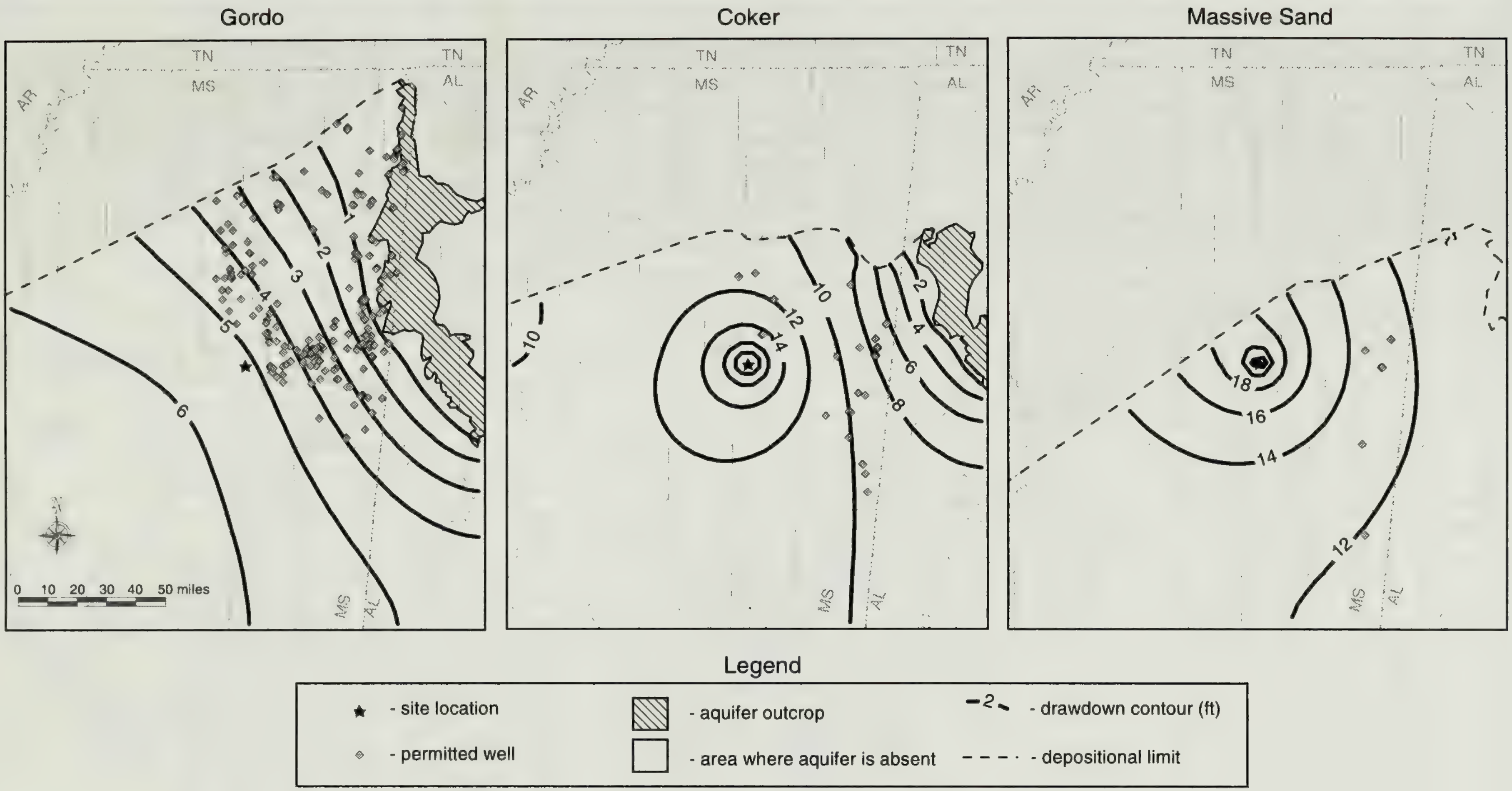
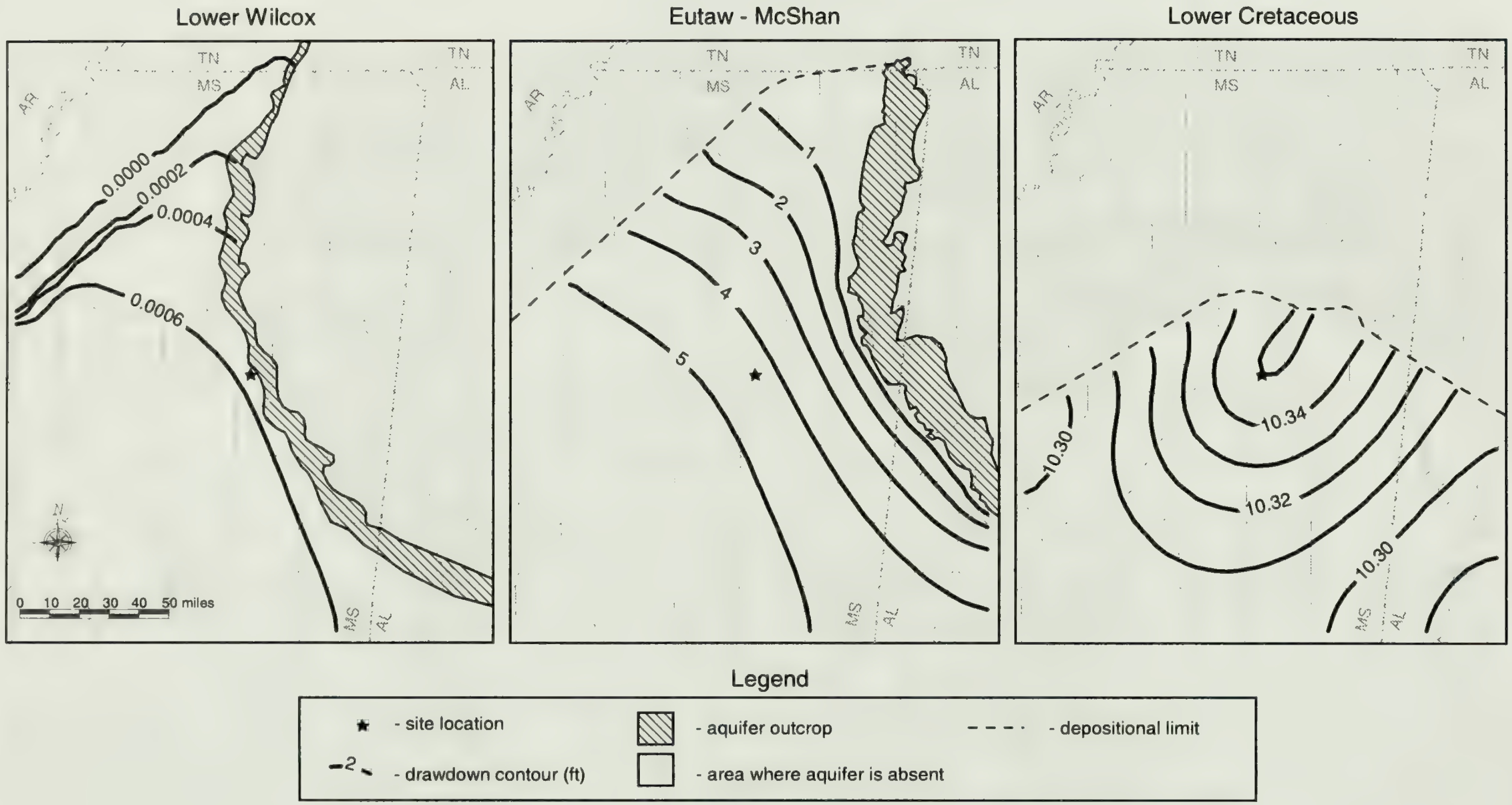


Figure 4.5-2 Predicted drawdown in the regional aquifers above and below the TAS at end of 30-year pumping simulation.



The potential for upconing of poor-quality water from the underlying Lower Cretaceous Aquifer would be low due to the presence of a clay aquitard at least 170 ft thick, which separates the Lower Cretaceous and Massive Sand Aquifers, and due to the relatively small vertical hydraulic gradient produced by groundwater withdrawals from the Massive Sand Aquifer. Simulations were performed of the movement of groundwater particles across the intervening aquitard in response to well-field pumping to investigate upconing potential. Particles initially positioned at the top of the Lower Cretaceous directly below the well-field showed negligible (i.e., less than 0.1 ft) upward particle movement by the end of the 30-yr simulation. Thus, the potential for degradation of the water quality in the Massive Sand Aquifer due to upconing appears negligible.

Similarly, lateral saltwater (i.e., defined here as water having a total dissolved solids concentration in excess of 10,000 mg/L) encroachment from down-dip regions of the Massive Sand Aquifer was examined through particle tracing during the groundwater flow model simulations. The exact position of the saltwater interface in the Massive Sand is uncertain. Strom and Mallory (1995) place the interface about three miles west of the project site, while R.W. Harden & Associates (1997) suggest the location is more likely located five to ten miles west of the site based upon their examination of geophysical logs for test wells in the region. Given the uncertainty, two lines of particles representing the saltwater interface were tracked during the model simulations: one initially located three miles west and another located five miles west of the generation facility well-field. Maximum horizontal particle displacements at the end of the 30-yr pumping simulation were approximately 1,250 ft from the three-mile line, and 685 ft from the five-mile line. It can safely be assumed that pumping-induced saltwater encroachment in the overlying aquifers would be even less than that predicted in the Massive Sand, because the magnitude of drawdown in these aquifers is less than that in the Massive Sand. On the basis of these results, significant lateral saltwater encroachment in the TAS aquifers due to long-term well-field pumpage is not anticipated.

Experience has shown that extensive groundwater pumpage from unconsolidated aquifer-aquitard systems could cause land subsidence (Freeze and Cherry 1979). Conditions involving large potentiometric declines and highly compressible aquitards are most favorable for the occurrence of subsidence. Neither condition is anticipated at the project site. Potentiometric declines during well-field operations would be relatively small (i.e., less than 40 ft) and widespread. Most of the aquitard sediments encountered during Test Hole 1, particularly those below the Lower Wilcox, were semi-consolidated to consolidated. Land subsidence in the site vicinity due to 30 years of pumpage is conservatively estimated to be less than 0.1 ft. This estimate is based on the one-dimensional (vertical) soil consolidation theory (Freeze and Cherry 1979); groundwater model estimates of the average drawdown in each hydrostratigraphic layer within an approximate three-mile radius of the well-field; and the aquifer-aquitard storage parameters assumed in the model (see Appendix D-4). The predicted subsidence in the site area is considered insignificant.

Ash Management – Fly ash and bed material derived from combustion of lignite or a combination of lignite and wood waste would be marketed for beneficial use or managed onsite. Any ash material managed onsite would be placed in designated ash management units constructed in accordance with MDEQ solid waste disposal regulations to ensure groundwater protection. Further information regarding ash management and other solid wastes generated by generation facility operations is presented in Section 4.18.1.2.

Mine

Pit Water Control – The Wilcox overburden materials in the mine area are composed primarily of clay, silt, lignite, and some discontinuous thin fine sands generally having low hydraulic conductivity and low water-supply potential. Because of the character of these overburden materials and their low production potential, dewatering with wells prior to mining would not be required. Mine pit inflows would be dependent on pit location, length and geometry, thickness, hydraulic conductivity, position and lateral extent of water-yielding strata in and adjoining the highwall, and the rate of mining (Section 2.2.2). Because of the many variables and changing highwall stratigraphy, pit inflows could vary greatly. Estimations of pit inflows were made using the methodologies found in US Department of Army, Navy, and Air Force (1971). Typical steady-state pit inflows in the five-year mine area are estimated to range from less than 50 gpm to about 350 gpm. Due to the limited lateral extent of overburden sands and observations in other Wilcox lignite mines, an average pit inflow within the five-year mine area of between 50 and 100 gpm is estimated. Some increase in pit inflow is expected in later years of mining due to the increase in the length of the pits (MLMC 1997).

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It is expected that seepage of groundwater into the mine pit would be removed by in-pit sump pumping. As mining progresses below the water table, local groundwater flow conditions would be altered as groundwater would move towards the mine pit and cause potentiometric declines around the excavation. These potentiometric declines principally would exist only in overburden zones being dewatered and only on a temporary basis. The extent of potentiometric level declines would be dependent on pit location and geometry, thickness, hydraulic conductivity, position and lateral extent of water-yielding strata in and adjoining the highwall, and the rate of mining. During reclamation backfilling, groundwater levels would begin to recover (MLMC 1997).

Due to the limited lateral extent of overburden sands present, no extensive modeling is practical or meaningful to project overburden potentiometric declines. However, to estimate the typical maximum lateral extent of potentiometric declines as a result of mining in the initial five-year mine area, an estimate was made based on methodologies in US Department of Army, Navy, and Air Force (1971). The CD sand zone was chosen for calculation purposes as it is the deepest and most laterally consistent sand in the overburden and so would, therefore, cause potentiometric declines furthest from the five-year mine area. Based on these calculations, potentiometric declines are estimated to be limited to distances of about 2,200 ft from the mine area, where such sands are laterally continuous to that distance. Where sands are laterally discontinuous, impacts would be more localized (MLMC 1997).

The deeper underburden sands beneath the seams to be mined are generally thicker, more laterally

continuous, and could provide significant supplies of water to wells. Significant underburden sands are separated from the mine floor by thick, low hydraulic conductivity clay, lignite, and silty clay layers rendering depressurization unnecessary. No mining activities would extend into significant underburden sands. Therefore, the quantity and quality of groundwater within these significant underburden sands (i.e., the Lower Wilcox Aquifer) would not be affected by mining, and would remain available for development before, during, and after mining (MLMC 1997).

Existing groundwater usage in the project area is small based on the well and spring inventory described in Section 3.5.3. As indicated on Figures 3.5-2 and 3.5-3, only seven currently used wells and one currently used spring would be mined through. Ten currently used wells and springs exist outside the mine area, but could be close enough to be potentially impacted. Impacts to the latter wells and springs would be limited to declines in water levels and/or flows. If these water sources would be adversely affected by mining, users would be provided an alternative source of water supply by the MLMC. Therefore, no adverse impacts on local water availability are anticipated as a result of the mining activities. The recreational spring in the Jeff Busby developed area is not ~~one of the~~ springs expected to be affected. The spring emanates from the northeast side of Little Mountain at an approximate elevation of 450 ft-msl. Mining operations would come no closer than about 2,000 ft to the spring and would not disturb the spring's recharge area which lies outside, and generally well above, the mine area.

<u>Long-Term Effects of Mining on Groundwater Availability</u> – Following mine reclamation, groundwater movement and levels in replaced spoil would be dependent upon the final topographic configuration, recharge, and hydraulic characteristics of the reclaimed spoil materials. Postmining groundwater movement patterns would likely approximate premining flow since postmining and premining topography would be similar. As equilibrium conditions were re-established in the spoil, it would be possible that seeps and springs may develop to provide natural discharge points for excess recharge. These springs and seeps would not be likely to occur at the same locations as existing springs and seeps. However, they would likely occur at lower elevations along local drainages similar to the existing springs and seeps (MLMC 1997).

During reclamation backfilling, the redistribution of sediments could result in increases in porosity, and changes in storage characteristics, horizontal and vertical hydraulic conductivities, and recharge capacity of overburden materials. Removal and redeposition would probably result in mixing of soils and stratigraphic changes which would likely increase vertical hydraulic conductivity and porosity. As a consequence, local recharge characteristics in spoil materials could be slightly enhanced from premining conditions. However, the regional effect on recharge to aquifers of the Wilcox Group would be negligible. The entire area to be mined would be about 3,800 acres, while the outcrop of Wilcox Group in Choctaw County alone covers about 265,000 acres (MLMC 1997).

Changes in the hydraulic characteristics of the replaced overburden could affect future use of replaced overburden as a source of groundwater supply. However, currently the undisturbed overburden Wilcox in the proposed mine area is limited as a water-supply source, supplying only small well yields and spring flows (i.e., seven wells and one spring currently being used within the proposed mining area).

With abundant alternative groundwater supplies available from the Lower Wilcox Aquifer and from local public water commissions, the impact of changes in hydraulic properties of the overburden in the mine area are expected to insignificant (MLMC 1997).

Mining Effects on Groundwater Quality – Acid-forming materials (AFM) or toxic-forming materials (TFM) are not expected to cause significant groundwater quality degradation in the reclaimed spoil areas. Mining operations would be conducted so as to minimize potential impacts to local groundwater quality in laterally-adjacent overburden sediments outside the mining area. As discussed in Section 3.3.3, approximately 5% of the overburden core samples showed problematic pyritic sulfur contents in excess of 0.5%. All of the pyritic sulfur observed in the core samples was associated with unoxidized sediments. The oxidized overburden materials which contain no acid-forming pyritic sulfur, would be handled by truck/shovel operations, and would be used in reconstruction of postmining soils. Special handling techniques would be applied to unoxidized overburden known to contain AFM or TFM to prevent acid or toxic drainage. These techniques would include special placement of AFM or TFM spoils at depths that would preclude seepage, acid neutralization by mixing with a source of alkalinity, or other approved methods. This would reduce any potential geochemical problems. Mitigative actions, such as construction of anoxic limestone drains or addition of buffering agents, would be implemented should acidic seeps occur (MLMC 1997).

Groundwater quality in the Lower Wilcox Aquifer, the principal aquifer in Choctaw County, would not be adversely impacted by mining operations. The Lower Wilcox is separated from the deepest seams to be mined by approximately 80 to 100 ft of low-permeability sediments primarily composed of clay, silty clay, and lignite (MLMC 1997). This confining unit would prevent significant downward percolation of any potentially degraded groundwater from the overlying reclaimed spoil areas.

Postmining groundwater quality in the reclaimed mine area cannot be predicted with certainty, but based on past histories of other similar mines, would likely have higher total dissolved solids than premining groundwater. Therefore, development of shallow freshwater wells in mine spoil deposits might not be feasible in the foreseeable future. However, sufficient freshwater would be available from the Lower Wilcox Aquifer and public water systems during and after mining.

Groundwater Use for Mining – Groundwater would be used for non-drinking water requirements of the mine office and shop facilities, including fire suppression and makeup water for the truck wash bay. The long-term average withdrawal rate during the mining period would be approximately 0.01 mgd with peak short-term pumpage of up to 100 gpm. The effect of pumpage would be limited to insignificant declines in the local potentiometric levels in the Lower Wilcox Aquifer. Predicted drawdowns beyond a distance of 0.5 mile from the supply well are estimated to be on the order of one foot or less for both peak short-term usage and long-term average pumpage. None of the private water supply wells in the project locality are expected to be adversely affected.

Water Quality Effects from Lignite Storage – Lignite excavated from the mine would be transported by truck to an interim storage area located just north of the mine office/shop facilities. The storage site would be situated atop a compacted spoil area and would have an approximate footprint area of eight acres. Incident precipitation on the lignite stack can be expected to produce leachate which would ultimately runoff, evaporate, and/or infiltrate into the underlying sediments. Results of EPA Method 1312 Synthetic Precipitation Leaching Procedure (SPLP) tests performed on two lignite samples are presented in Table 4.5.1.2-1. Trace element concentrations of both leachate samples are all below EPA drinking water MCLs (where applicable). Considering the relatively benign characteristics of the lignite leachate, no adverse impacts to groundwater or surface water quality are expected. However, a small sump could be installed, if needed, to control lignite fines.

Table 4.5.1.2-1 SPLP Test Results for Two Lignite Leachate Samples (Source: Hassett et al. 1997)

Parameter	Sample SPLP1 (mg/L)	Sample SPLP2 (mg/L)	EPA MCL (mg/L)
Arsenic	<0.004	<0.004	0.050
Barium	<0.1	<0.1	2.0
Cadmium	<0.0003	<0.0003	0.005
Chromium	<0.05	<0.05	0.10
Lead	<0.002	<0.002	0.05
Mercury	<0.0001	<0.0001	0.002
Selenium	0.019	0.020	0.05
Silver	<0.0003	<0.0003	0.1000
Boron	1.0	1.0	--
Copper	<0.1	<0.1	1.3
Molybdenum	0.0078	0.0073	--
Nickel	<0.07	<0.07	0.10
Vanadium	<0.04	<0.04	--
Zinc	<0.03	<0.03	--
pH	7.62	7.15	6.5 to 8.5

– hydro-carbons

Transmission Lines and Natural Gas Pipeline

No adverse impacts to groundwater resources are anticipated from operation and maintenance of new transmission lines proposed for the project. If TVA decides to use herbicides in the maintenance of ROWs, only EPA-registered herbicides labeled for ROW use would be selectively applied by licensed personnel so as to minimize public exposure and water resource contamination. In particular, areas surrounding any wells or springs along the ROW would be avoided in the application of herbicides.

4.5.1.3 Combined Impacts of Generation Facility and Mine

The primary adverse impacts of the generation facility and mine on groundwater resources would include: (1) minor short-term and long-term groundwater potentiometric declines in regional aquifers resulting from generation facility groundwater use and mine pit dewatering, (2) potential degradation of

existing groundwater quality due to generation facility and mine operations groundwater withdrawals, and (3) potential changes in the hydraulic and water quality characteristics of the reclaimed mine zone that would preclude future shallow groundwater development.

Predicted drawdowns at existing TAS well sites resulting from long-term groundwater pumpage of 6.33 mgd for generation facility water supply are less than 15 ft, and are expected to produce insignificant increases in pumping lifts and associated costs to existing TAS users. Estimated drawdowns in the overlying regional aquifer are insignificant (i.e., less than five feet), and therefore would not add significantly to potentiometric level declines resulting from mine pit dewatering and other shallow groundwater use for mining operations. Long-term potentiometric level declines due to mine pit dewatering and groundwater use would be limited to distances of about 0.5 mile from the mine area. Currently, there are ten actively used wells and springs outside the mine area that potentially could be impacted. If these water sources are adversely affected by mining, users would be provided an alternative source of water supply by MLMC.

The potential for adverse groundwater quality impacts to shallow groundwater resources from mining operations is low. The pH of the overburden sediments is near neutral and only a scattered presence of AFM and TFM have been detected in the lower unoxidized portions of the core samples. Special handling techniques would be applied to unoxidized overburden known to contain AFM or TFM to prevent acid or toxic drainage. Mitigative actions, such as construction of anoxic limestone drains, would be implemented should acidic seeps occur. Long-term groundwater pumpage from the Massive Sand Aquifer for generation facility cooling water supply is expected to result in negligible degradation of groundwater quality of the Massive Sand Aquifer. The saltwater-freshwater interface is projected to advance towards the facility well-field by at most 1,250 ft over the estimated 30-yr facility life. Therefore, significant encroachment in the TAS aquifers due to long-term well-field pumpage is not anticipated.

Reclaimed spoil within the mine area might not be suitable for future shallow groundwater development due to changes in the hydraulic and water quality characteristics of the replaced overburden materials. This adverse impact is not considered significant because (1) the overburden deposits currently represent a minor aquifer supplying few active wells, and (2) cost-effective alternative water sources are available from public water systems and from the Lower Wilcox Aquifer.

4.5.2 No Action Alternative

In the absence of the proposed project, the population in the project area would probably not change substantially in the foreseeable future. Therefore, groundwater availability and quality would remain essentially unchanged. However, in the event the generation facility and mine were built and operated independent of TVA's involvement, impacts to groundwater would be expected to be similar to those described in this EIS.

4.6 Surface Water Resources

4.6.1 Action Alternative (Project as Proposed)

4.6.1.1 Construction Impacts

Generation Facility

Impacts from construction of the generation facility on the existing hydrologic system would be small and limited to areas immediately adjacent to the facilities. Only unnamed tributaries to Middle Bywy Creek and Besa Chitto Creek would be affected. Excess stormwater during construction would be handled in accordance with the facility SWPP Plan. These plans would be designed to prevent increased runoff from new land development, minimize the erosion potential, assure the adequacy of culverts, and prevent contaminated runoff from leaving the site. Details of the Construction SWPP Plan are contained in the Facility Description (Burns & McDonnell 1997) and the National Pollutant Discharge Elimination System (NPDES) permit application (Malcolm Pirnie 1997a). Implementation of the plan would minimize the potential for any adverse impacts from stormwater runoff. Portable toilets would be provided for construction and outage crews. These actions should not cause any significant impacts.

Mine

Impacts from construction activities on the existing hydrologic system would be small and limited to areas immediately adjacent to construction. Creeks, tributaries, and impoundments within the construction area would be temporarily removed by mining. However, stream segments would be rerouted prior to their temporary removal. After reclamation, streams would have similar characteristics to the original streams. Details are contained in the reclamation sections of the mine permit application (MLMC 1997). Little Bywy Creek and Middle Bywy Creek are the most significant surface water resources that would be affected. Diversion of portions of channels of these creeks around mine blocks would protect the integrity of the water quality. Construction of other surface water control systems such as sedimentation ponds would also protect local surface waters and the hydrologic balance of the watersheds where construction activities take place. During construction of the sedimentation ponds and during some other construction activities, BMPs would be in place to control runoff, in accordance with the SWPP Plan. Any impact of the surface water control system on the local hydrologic balance would be minimal and insignificant.

good

Surface water impacts associated with construction activities would be related to clearing of vegetation and construction of facilities in advance of the active mining pit. Construction of surface water control systems would include stream diversions to protect undisturbed runoff from mining activities, erosion control features, and sedimentation ponds to remove sediments produced in the construction process. Design criteria and details of these systems are provided in the mine permit application (MLMC 1997).

<u>**Transmission Line and Natural Gas Pipeline**</u>

The proposed 161-kV transmission line from the RHPP to the substation at Sturgis, Mississippi, would be 10.3 miles long for Corridor A and 10.9 miles long for Corridor B, with a cleared ROW width ranging from 100 to 175 feet. The routes are shown on Figure 2.2.3-1. Corridors A and B would cross about 18 and 20 tributaries, respectively, of the Yockanookany River (west of Ackerman) and the Noxubee River (east of Ackerman) watersheds, beginning with Besa Chitto Creek at the facility site. The respective routes would also replace about 114 and 122 acres, respectively, of timber with grassy/shrubby cover.

The proposed natural gas pipeline would parallel Corridor A of the electric transmission line, from the trunk line two miles north of Ackerman to both the EcoPlex and the generation facility. It would be about three miles long, and the cleared ROW would be only 5 to 20 ft wide.

Other potential surface water impacts include actual stream disturbance by clearing, construction, or maintenance vehicles; runoff and spillage of toxic materials such as oil, gasoline, and herbicides; and blockage of streams by debris and refuse. These potential impacts would be avoided by project-specific BMPs and daily work procedures so that they do not become significant problems.

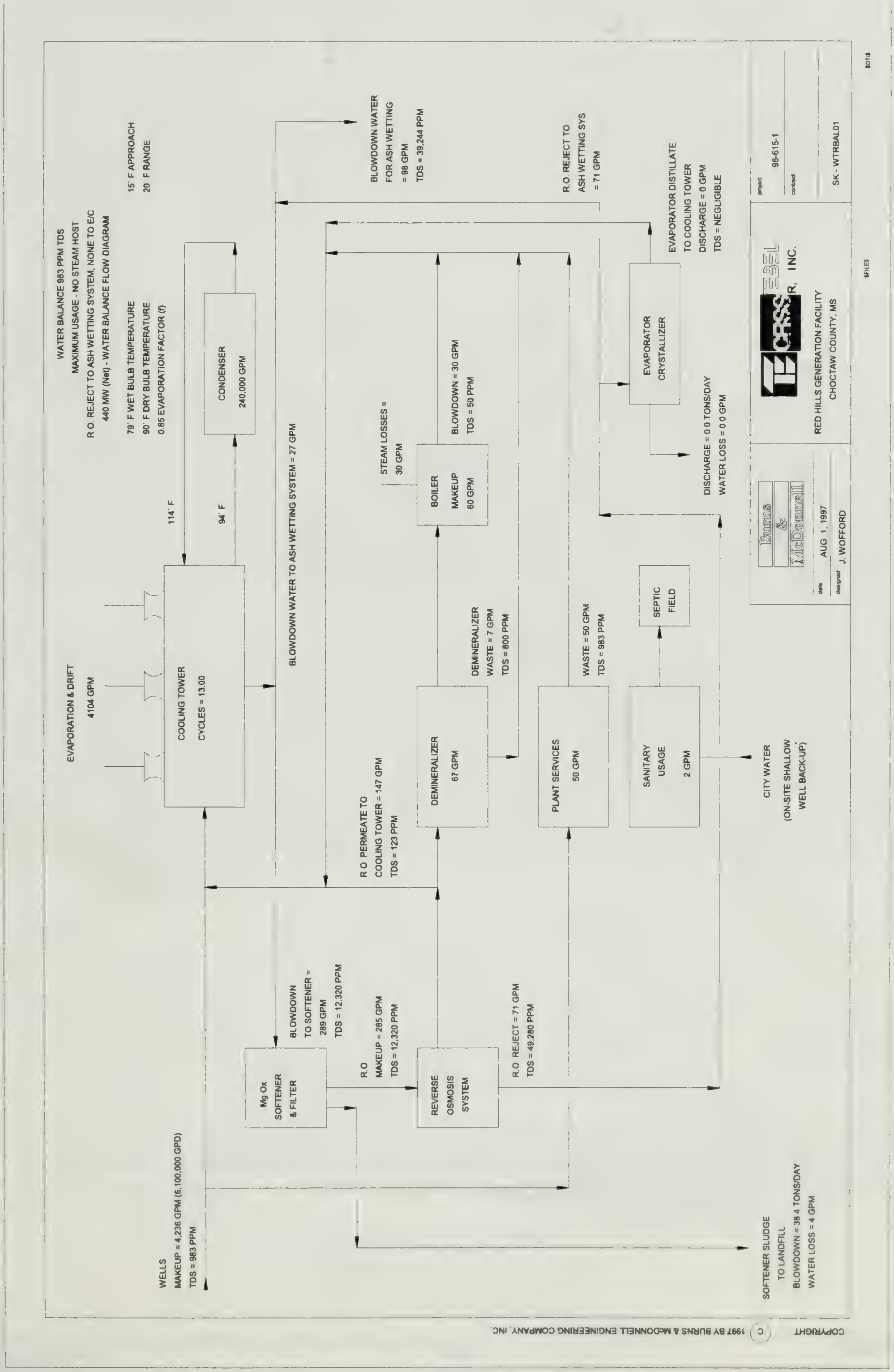
During construction and the development period for the grassy/brushy cover, both sediment losses and runoff may substantially increase; however, construction and maintenance of the 161-kV transmission line would utilize a mix of TVA's BMPs for transmission line activities (Muncy 1992). These practices include very effective methods for minimizing these potential impacts. Equivalent practices are assumed to be used for the natural gas pipeline construction and maintenance activities.

4.6.1.2 Operational Impacts

<u>**Generation Facility**</u>

<u>Process Wastes</u> – The RHGF would function as a zero discharge facility for process waters. The facility would be designed to minimize the use of water and to maximize its reuse. As described in Section 2.2.1.3, all process wastewater would be treated and reused. Sludges and waste solids would be removed and disposed in an approved regional landfill. The flowchart and water mass balance are depicted in Figure 4.6.1.2-1. Facilities associated with the wastewater, chemicals, and waste solids would be designed to preclude seepage or loss of containment of the materials. A Distributed Control System (DCS) would automatically monitor and supervise the status of equipment and key processes, minimizing improper or dangerous operation due to operator error or equipment malfunctions. These measures would be combined with implementation of a Spill Prevention Control Countermeasure (SPCC) Plan and other BMPs to minimize the potential for accidental and nonpoint source pollution. Consequently, the facility process waters and wastes are not expected to adversely impact local water resources.

Figure 4.6.1.2-1 Flowchart and water mass balance for proposed generation facility.



Stormwater Management–Excess stormwater would be discharged after routing through sediment basins. One outfall would discharge to the north to an unnamed tributary of Middle Bywy Creek and another would discharge to the south to an unnamed tributary of Besa Chitto Creek. The drainage plan for the generation facility is shown on Figure 4.6.1.2-2. Stormwater runoff from the wood waste storage area would be routed to the southern sediment basin. The lignite would be stored in an enclosure and would not be exposed to rainfall. All conveyors would also be enclosed. Runoff from the ash management unit would be routed through the northern sediment basin and treated as necessary to meet NPDES permit limits for suspended solids and any other regulated pollutant. An SWPP Plan would be prepared for operation of the generation facility.

Runoff from the ash management unit could contain high concentrations of total dissolved solids (TDS). Blowdown from the cooling towers and possibly the reverse osmosis (RO) reject waste stream could be used to moisten the waste ash to control dust during the hauling and placement in the ash management unit. The dissolved solids in the cooling tower blowdown are estimated to be 12,300 ppm. The concentration of the combined blowdown and brine concentrate would be about 39,200 ppm. The TDS would consist primarily of the major cations and anions contained in the raw water supply. A chemical analysis of the water supply is provided in Appendix C-13 (data for the TAS). The major constituents are sodium, potassium, chloride, and bicarbonate. Much smaller percentages of potassium, calcium, magnesium, sulfate, silica, and iron would be present, as well as small quantities of commercial corrosion and scale inhibitors which would be added to the water.

Rainwater falling on the ash would transport most of the various constituents contained in the TDS to the runoff sedimentation pond below the ash management unit. This pond is shown Figure 2.2.1.3-3. The quantity of TDS transported would vary with each rain event, depending primarily on the quantity of TDS contained in the ash, the amount of runoff, the permeability of the ash, and the quantity of ash exposed to the rainfall. Results of a "worst-case" mass balance analysis are presented in Table 4.6.1.2-1[1]. Calculated TDS concentrations for the ash management unit runoff range from 2,677 mg/L for the cooling tower blowdown option to 8,541 mg/L for the combined blowdown and brine concentrate.

[1] These calculated values should not be considered as representative of actual concentrations because of the gross assumptions used. They are intended for impact assessment purposes only. These calculations assume leaching of all TDS in the ash. This assumption is conservative. Leachability is expected to be substantially lower.

Figure 4.6.1.2-2 Conceptual drainage plan for proposed generation facility.

Conceptual Drainage Map
Red Hills Generation Facility
Choctaw County, Mississippi

MS PREPARED BY TVA LAND MANAGEMENT, GEOGRAPHIC INFORMATION AND ENGINEERING, RESOURCE MAPPING

Table 4.6.1.2-1 Mass Balance Analysis Results, Total Dissolved Solids from Ash Storage Runoff

	Drainage Area (Acres)		Estimated TDS Concentration (mg/L) in Ash Storage Runoff*		Estimated TDS Concentration (mg/L) at Mass Balance Location Resulting from:*		
Mass Balance Location	Watershed	Ash Storage	Cooling Tower Blowdown (CTB) Option	CTB & Brine Concentrate Option	Mining Only**	Mining & CTB Option	Mining & CTB & Brine Concentrate Option
Middle Bywy Creek near NT Parkway***	8,096	100	2,677	8,541	286	322	351
Monitoring Station SW-1	18,830	100	2,677	8,541	171	184	215
Big Bywy Ditch at Confluence with Middle Bywy Creek	69,385	100	2,677	8,541	83	87	95

* Based on the following assumptions:

98 gpm blowdown with a TDS concentration of 12, 298 mg/L for the CTB option and 40,000 mg/L for the CTB & Brine Concentrate;

0.5 in. runoff or leachate from the ash area to the sedimentation pond;

30 days ash accumulation between rainfalls;

all available TDS in ash is washed out during the rain event; and runoff is equal for all portions of the drainage area

** Assumptions are listed in Table 4.6.1.2-2.

*** Location is about 1,900 ft downstream of the Natchez Trace Parkway

Compared to background TDS concentration of about 50 mg/L, the increase in TDS in the headwaters of Middle Bywy Creek would be large. However, its significance is considered to be small because of the following factors.

- The headwater area is currently ephemeral and intermittent and cannot be used on a practical basis for water supply, fish and wildlife, or other uses typical of perennial water bodies.
- None of the constituents contained in the effluent are considered to be toxic.
- The actual increase in TDS are likely to be much less than implied by these calculations.

Sanitary Wastewater – Sanitary wastewater would be collected and discharged to an onsite septic system approved by the local health department.

Mine

Probable Hydrologic Consequences – Stormwater runoff from active mining areas is expected to slightly increase primarily due to removal of vegetation and subsequent reduction in abstraction capacity. However, the total disturbed acreage of active mine area would remain relatively constant over time. In addition, the total acreage of drainage controlled by the sedimentation ponds would be small. For the five-year permit term, the watersheds of SP-1, SP-2, and R-1 would contain about 9% (1,660 acres) of the watershed area of station SW-1 and less than 2% of the drainage at the confluence with Big Bywy Ditch (see Figure 3.6.1-1). As such, annual runoff downstream of the sedimentation ponds would experience negligible variations from existing conditions. Measurements performed at other lignite mines in the Gulf Coast support this conclusion (Sabine 1993).

baseflow contribution?

Although total stormwater runoff could increase slightly in active mine areas, peak flows in Little Bywy Creek and Middle Bywy Creek would be reduced by the attenuation of flood peaks due to temporary storage in the sedimentation ponds. Sedimentation ponds typically would have sufficient storage for the runoff of the 10-year, 24-hour storm event (6.2 inches for the Red Hills Mine area). Because the temporary flood storage pools of the sedimentation ponds would be dewatered after treatment and clarification through gate-controlled primary spillways, water releases could be controlled to avoid erosion and flooding downstream in Little Bywy Creek and Middle Bywy Creek. In summary, the major effect of the proposed surface water control system would be the partial attenuation of flood flows, with total storm runoff experiencing negligible variations from existing conditions.

Soon after regrading and replanting, runoff characteristics in Little Bywy Creek and Middle Bywy Creek are anticipated to return to approximate baseline conditions. The truck/shovel operation used for the selected overburden material would result in upper soils remaining at approximately the same stratigraphic position. Therefore, postmining soils are expected to be similar to premining soils from a runoff standpoint (predominantly hydrologic soil group "C"). Postmining land use is expected to be primarily forest as is the current premining land use. Final regrading would approximate the original contours, except at the headwaters of Little Bywy Creek and Middle Bywy Creek, where some of the ravines would be filled with excess overburden to create gentler slopes. Therefore, reduction in runoff

velocities could occur due to postmining topography resulting in slightly reduced peak flows. Total runoff volume for postmining conditions would essentially equal premining conditions.

Within the proposed mine area, several small capacity springs and seeps presently exist. The field inventory indicates that the total flow of springs likely to be affected by mining activities would be approximately 75 gpm, or 0.17 cfs. Even if these springs and seeps were not to return upon final reclamation, the total amount of flow from springs inventoried and projected to be affected by mining activities is relatively small and amounts to less than one-half of one percent of the average flow at station SW-1.

Surface water quality concerns associated with lignite mining would include the potential for increased sediment loading, acid or toxic drainage, and increases in iron and total dissolved solids in runoff from active mine areas. As required by the mining regulations, all surface drainage from active mining areas would be routed to sedimentation ponds, monitored, and treated, if required, prior to release. Discharges from the sedimentation ponds are subject to new source performance standards (40 CFR, 434 Subpart C) for total suspended solids (TSS), total iron, pH, and settleable solids (SS). These discharges would be controlled by permit limitations to meet the applicable performance standards. The environmental significance of these discharges is discussed in subsequent sections.

To bring into perspective potential impacts on surface water quality, a worst-case mass balance analysis was conducted using total dissolved solids (TDS) as an indicator parameter. Table 4.6.1.2-2 gives a relative indication of some localized changes in water quality. Concentration of TDS under the assumed conditions would increase from about 50 mg/L to 100 to 300 mg/L if not treated prior to discharge (depending upon downstream location), but would still be well below the drinking water standard of 500 mg/L. Effects would be substantially reduced within short distances downstream due to dispersion and dilution. Concentrations would approach baseline levels at the downstream end of Middle Bywy Creek. However, discharge limitations for pH, TSS, total iron and SS are within the range of the natural conditions of the local streams. Therefore, compliance with the applicable effluent limitations, coupled with the small proportional contribution of actively disturbed mine areas to the streamflows of Little Bywy Creek, Middle Bywy Creek, and Big Bywy Ditch would preclude significant adverse impacts on the downstream water quality.

<u>Acid or Toxic Forming Materials</u> – The selected overburden handling plan would result in avoidance of potential chemical problems caused by mixing oxidized and unoxidized overburden. In addition, only a scattered presence of acid-forming materials has been detected in geochemical cores, and only in the unoxidized portions of the cores.

Table 4.6.1.2-2 Mass Balance Analysis Results-Total Dissolved Solids

For Five-Year Mine Plan					
Mass Balance Location	Acres of Drainage for Disturbed Area*	Acres of Undisturbed Drainage	Assumed Disturbed TDS Concentration**	Measured Baseline TDS Concentration	Estimated Resulting TDS Concentration
Monitoring Station SW-5	1,470	5,422	500	50	146
Monitoring Station SW-1	2,630	16,200	500	50	113
Big Bywy Ditch at Confluence with Middle Bywy Creek	2,630	66,755	500	50	67
For Life-of-Mine Plan***					
Mass Balance Location	Acres of Drainage for Disturbed Area*	Acres of Undisturbed Drainage	Assumed Disturbed TDS Concentration**	Measured Baseline TDS Concentration	Estimated Resulting TDS Concentration
Monitoring Station SW-5	3,470	3,150	500	50	286
Middle Bywy Creek near NT Parkway****	4,052	5,044	500	50	250
Monitoring Station SW-1	5,080	13,750	500	50	171
Big Bywy Ditch at Confluence with Middle Bywy Creek	5,080	64,305	500	50	83

* Total drainage area of applicable sedimention ponds which control mine drainage.

** Receiving stream segment standard for drinking water.

*** Assuming all mine areas are in disturbed condition.

**** Location is about 1,900 ft downstream of the Natchez Trace Parkway.

All results in mg/L.

Throughout most of the mine area, overburden materials do not contain acid-forming or toxic-forming materials (AFM and TFM). If such materials were encountered, and where hydrologic conditions could make such materials susceptible to seeping, selected overburden material handling techniques would be utilized in order to prevent the occurrence of significant acid or toxic drainage. These techniques could include placement of spoil containing AFM and/or TFM at depths that prevent potential seepage, and the addition of alkaline material such as lime or limestone. If acidic seeps do occur, mitigative actions such as the construction of anoxic limestone drains could be taken. Therefore, no acid-forming or toxic-forming materials are expected to impact postmining groundwater or surface water.

Alteration of Surface Water Supplies/Uses – No users of surface water for domestic, agricultural, industrial, or other permitted purposes are known to exist within the immediate mine area or adjacent areas. A few ponds used for stock watering purposes (see Section 3.6.1.3) are expected to be removed during mining, but if ponds are needed after mining, they would be rebuilt as part of the reclamation plan. Stream segments would also be rerouted and reconstructed with similar characteristics to the original steams. Consequently, there is not expected to be any significant alteration of surface water supplies or uses.

Alteration of Sediment Yield – During active mining and reclamation, runoff from disturbed areas would be collected and treated in sedimentation ponds, which would be constructed in accordance with the regulations and operated to comply with established effluent limitations for disturbed area runoff. Therefore, sedimentation impacts on downstream water quality would be minimized during the mining and reclamation phases.

In order to quantify long-term changes in sediment load characteristics attributable to the mining and reclamation activities, a comparative analysis of premining and postmining sediment loads was conducted based on the Universal Soil Loss Equation (USDA ARS 1961) for average annual sediment load computations and the Modified Universal Soil Loss Equation (Williams 1975) for single-storm sediment load computations. Based upon premining computations for Little Bywy Creek and Middle Bywy Creek, gross premining sediment loads (weighted by drainage area) averaged approximately 2.1 tons/acre on an average annual basis, with corresponding single-storm (10-year, 24-hour) loads averaging approximately 0.7 tons/acre. Computed postmining sediment loads (based on projected postmining topography, soils, land use, and rainfall-runoff characteristics) are approximately 1.3 tons/acre and 0.5 tons/acre, respectively, for average annual and 10-year, 24-hour conditions. The computed annual and single-storm sediment loads represent decreases of approximately 36 and 30%, respectively, in comparison with average premining (baseline) conditions. These projected decreases in average sediment loads would be attributable to the less steep overland slopes associated with the postmining topography in some of the sub-basins, since the other parameters in the computations are not expected to significantly vary from baseline conditions. The minor alteration of sediment load characteristics is not expected to result in any adverse impacts on downstream water quality, or in geomorphic instability for Little Bywy Creek, Middle Bywy Creek, or Big Bywy Ditch under long-term conditions.

Alteration of Water Quality Parameters – Based on available baseline data (hydrology, water quality, and overburden geochemistry), discharges from the mining activities are not expected to result in adverse water quality impacts to the receiving streams (Little Bywy Creek and Middle Bywy Creek) due to acidity, TSS, TDS, or other pertinent water quality parameters. The collection and detention of disturbed area runoff in sedimentation ponds would reduce suspended solids concentrations to allowable levels. In addition, any adverse impacts due to acidity (although not anticipated based on available overburden geochemistry data) would be precluded by treatment in the sedimentation ponds if necessary, to comply with effluent limitations for pH. The design of the sedimentation ponds would allow for the storage and controlled release of runoff resulting from storms up to a 10-year, 24-hour event. Total dissolved solids, conductivity, chloride, sulfate, and iron concentrations may increase locally in mine discharges, but mine discharges are required to meet effluent discharge limitations. Overall surface water quality is expected to remain good.

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There may be changes in the characteristics of stream sediments as mining occurs since the overburden would be rearranged. Erosion and sediment control practices identified within this document and presented in more detail in the mine permit application (MLMC 1997) would minimize potential effects. The concentrations of metals contained in the overburden are similar to those contained in stream sediments in both Choctaw County and the Tennessee River Basin. When compared to the extensive data base for the Tennessee River Basin, the average concentrations for overburden metals were always lower than corresponding values for Tennessee River sediments. Consequently, mining is not expected to adversely impact the overall geochemical quality of sediments in the mine area. if true, this is good

Flooding or Streamflow Alteration – Runoff volumes from active mining areas temporarily would be increased as land is cleared for mining. However, contributions to peak discharges downstream of the mining areas would be decreased as a result of temporary impoundment of runoff in the sedimentation ponds. Although the individual sedimentation ponds substantially would reduce localized flood peaks at their points of discharge into adjacent receiving streams, the effects of these alterations on the flood peaks of the receiving streams would be very minor due to the differences in drainage areas and lag times between the receiving streams and the small local watersheds controlled by the ponds. Controlled discharges from the sedimentation ponds, through valved outlet structures, would tend to sustain downstream flows for longer periods following storms. Collection and discharge of precipitation falling on the active pit would be a similar sustaining effect on post-storm streamflows within the local watersheds. However, these changes in streamflow characteristics would be short-term, occurring only in periods immediately following storms, and would be minor in magnitude due to the small proportion of the receiving watersheds (Little Bywy Creek, Middle Bywy Creek, and Big Bywy Ditch) affected by the mining operations at any particular time. ~~Because of the much larger drainage area of Big Bywy Ditch, no discernible changes in streamflow~~ characteristics (either effects on peak discharge rates or sustained flow characteristics) are expected in this watershed due to the mining and reclamation activities.

(*)

There could be a discernible change in streamflow characteristics of Little Bywy Creek and Middle Bywy Creek. Baseflow during extended dry periods could be reduced due to the effects of overburden

replacement. Flows are sustained currently by perched groundwater formed by relatively impermeable lenses beneath sandy layers. These conditions create the local springs and seeps. Replacement of the overburden layers during mining would blend the soils, resulting in a more uniform permeability that may minimize reestablishment of perched groundwater conditions. The net effects are expected to be more recharge to the true groundwater table and less recharge to streams within the mine area. Consequently, smaller average daily flows may occur. The number of days of no flow for stream segments and the total stream length classified as intermittent may also increase. These potential effects would be partially offset by the controlled discharge from the sedimentation ponds following storms. The effects would be localized to the mine area and are not expected to be discernible within the much larger drainage area of Big Bywy Ditch. The significance of these local effects is small.

Following reclamation, the hydrologic characteristics would gradually approach premining conditions. Sedimentation ponds would be maintained until runoff quality is sufficient, based upon the established effluent limitations, to allow for the removal of temporary ponds or the conversion of the some ponds to permanent surface water impoundments. Hence, the effects of the sedimentation ponds on downstream flow characteristics noted previously (lower flood peaks and longer sustained flows following storms) would occur to a lesser degree during the reclamation phase.

Under postmining conditions, runoff characteristics are expected to return to near premining conditions. Major changes in total runoff volumes between premining and postmining conditions are not anticipated as postmining soil types and land uses would return to near premining conditions. As postmining slopes are expected to be more gentle, postmining peak discharges would be reduced to a small degree. The very slight increases and decreases in runoff rates and volumes, attributable to minor changes in postmining topographic, soils, and land use characteristics, would be minor in terms of downstream hydrologic impacts or flooding potential on Little Bywy Creek, Middle Bywy Creek, and Big Bywy Ditch. In summary, the mining and reclamation activities associated with the Red Hills Lignite Mine would not result in any significant impacts on regional streamflow characteristics and would reduce flooding potential of area streams.

Surface Water Availability – The availability of surface waters within the mine area is limited, as previously described. This restricts the potential beneficial uses of the water. The only known users of surface water within the immediate mine plan area or adjacent area are farmers who have constructed ponds for livestock or private fish ponds. These ponds would be reconstructed, as requested by the individual landowners, during reclamation. Some of the larger sedimentation ponds may also be left for fish stocking, if approved in the final reclamation plan. The potential changes in postmining hydrologic characteristics of area streams are projected to be localized and regionally insignificant.

The consumptive use of water associated with mine operations is small, as shown in Table 4.6.1.2-3.

Table 4.6.1.2-3. Mine Operations Consumptive Water Use Estimate

Activity	Gallons/Month
Office/Shop	300,000
Equipment Washing	300,000
Dust Suppression (Peak)	3,000,000

Office and shop water would most likely be obtained from one of the public water supply systems furnishing the area. Water for dust suppression and equipment washing would be obtained primarily from sedimentation ponds, supplemented by groundwater developed from a well to be completed in the Lower Wilcox Aquifer. Water use for dust suppression would peak in the summer months and would be minimum during winter and wet months. The dust suppression water requirement indicated above would be for the peak months. More than sufficient water would be available from surface water and groundwater sources to meet mine water needs without significant impact to the overall availability of water in the area.

could be u[illegible] to augm[illegible] [illegible] low flow

Consequently, potential impacts on the availability of surface waters would be localized and at least partially mitigated through reclamation. Since surface waters are naturally limited, current use is also limited and restricted primarily to stock watering and private fish ponds. There are no anticipated adverse impacts on regional surface water availability as a result of the proposed mining and reclamation activities. If a landowner's water supply were to be affected by mining activities, MLMC would replace their supply, either through development of a new groundwater well or surface water, as available.

Sanitary Wastewater – The mine workforce would average about 131 employees during the life-of-mine, ranging from 120 to 138 people. During mine construction and development, the employment range would be 55 to 150. Sanitary facilities would include toilets, sinks, and wash basins at the mine shops and the office complex. Estimated sewage per person for the mine shops and office complex is 50 gpd for a total design flow of 10,000 gpd. A small extended aeration package plant would be installed to treat this sewage. The plant would be operated by a trained and certified operator to meet applicable limits contained in MLMC's NPDES permit. The treated effluent would be discharged to the surface impoundment/sedimentation pond nearest to the office complex. Portable chemical toilets would be provided for the active mine area. These toilets would be routinely serviced by contractors, and the wastewater would be disposed at approved treatment facilities. No adverse impacts are expected from these waste sources. The facilities would be operated and maintained by trained and qualified staff, and performance would be monitored to assure compliance with applicable permit limitations.

Surface Monitoring Program – An approved surface monitoring program would be implemented, including seasonal measurement of streamflows, water levels, and collection of surface water samples for specified quality parameters. Background sampling in local streams and overburden has been conducted. Regular collection of additional surface and groundwater samples would allow for ongoing verification of the effects of mining activities on the quantity and quality of surface water near the permit area. Monitoring data would be used to track conditions with respect to streamflow, spoil recharge, and quality

of water. As changes occur, monitoring data would be used to appropriately modify, if necessary, mining activities and to define and implement any appropriate mitigative actions.

Transmission Line and Natural Gas Pipeline

Potential impacts would include increased sediment loads and runoff quantities due to clearing, construction, and maintenance activities. Converting timber to grassy/brushy cover would increase the "C" factor used in Universal Soil Loss Equation from a value of about 0.003 (40 to 70% tree canopy, 75 to 85% forest litter with controlled grazing and fires) to about 0.011 (tall weeds or short brush, 75% canopy cover, 80% ground cover as grass). Consequently, long-term soil loss from the portion of the corridor modified from woods to grassy/brushy cover could be expected to increase about four times above the current rate. Conversely, the "CN" number used in the USDA Soil Conservation Service's TR-55 method for estimating runoff from urban areas decreases from about 70 (hydrologic soil group C, woods cover rated as good) to about 65 (C soils, brush cover rated as good), indicating that long-term runoff from the modified land use may decrease slightly.

4.6.1.3 Combined Impacts of Generation Facility and Mine

The percentage of land within the watersheds affected by these activities is small, at any given point in time, indicating that potential impacts would not be discernible outside the immediate local area. With the use of sedimentation ponds, discharge effluent limitations, and BMPs, quality and quantity are not expected to be significantly impacted. Reclamation of the mine, including overburden replacement, using a selected overburden material handling plan, approximate restoration of existing drainage patterns and topography, and creation of permanent impoundments could have some beneficial impact to the surface water qualities and quantities.

4.6.2 No Action Alternative

Under the No Action Alternative surface water would be unchanged from its present condition. Water quality and availability would remain at present levels. Area streams would remain in their present drainage, and no sedimentation ponds would be constructed. Additional stormwater runoff, sedimentation, process wastewater or sanitary wastewater could result from routine area development (e.g. industrial, commercial, or housing development). However this growth could be slow and incremental, and impacts to surface water would likely be insignificant. It is possible, however, that the proposed project would occur even if TVA should decide to take no action (i.e., decide not to buy the electricity generated by the facility). This could occur if another buyer were found for the output of the generation facility. In that event, the impacts of the action alternative would be similar to those described in this EIS.

4.7 Aquatic Ecology

4.7.1 Action Alternative (Project as Proposed)

4.7.1.1 Construction Impacts

Generation Facility

Construction activities associated with the proposed generation facility would include clearing and grading for haul roads, generation facility access, and the ash management unit. These activities would potentially increase runoff from the construction site during rain events resulting in adverse silt loads in offsite aquatic communities. During construction activities, BMPs would be used to reduce erosion and runoff from cleared areas. The impacts resulting from construction activity associated with the proposed generation facility are expected to be insignificant.

Mine

The effects of mine construction activities would be similar to those discussed for the generation facility. Clearing and grading of land areas for offices, shops/maintenance areas, etc., would increase surface water runoff from affected areas and potential sediment transport to receiving streams. Planned surface water runoff and sediment transport controls, provided for in the SWPP Plan, such as sedimentation ponds, fabric filter fences, and hay bale dikes and use of BMPs are expected to reduce these impacts.

Clearing of terrestrial vegetation in areas to be mined, construction of surface water control structures, and erection of administrative and service buildings are also planned. Some of the roads would cross area streams, as would embankments constructed for diversion and sedimentation ponds. Each activity could potentially discharge effluents to these streams, adversely impacting aquatic biota resulting from the (1) disruption of existing stream channels (e.g., stream realignment); (2) increases in suspended solids loading; (3) changes in nutrient inputs; (4) reduction in the shade and organic materials provided by riparian vegetation; and (5) alteration of existing flows.

The immediate effluent constituent of concern, in addition to increased rainwater runoff, is suspended solids (silt). The severity of impacts due to increased silt loads is dependent on the concentration of suspended material, the amount of sedimentation which takes place, and the nature of the soils and plants receiving the sediment. Fish would generally leave areas of high siltation and return when conditions are more favorable. Suspended solid loads may have an abrasive action on the gills of fish. Sudden increases due to extremely heavy precipitation on the project site could create some periodic short-term adverse impacts on the stream fisheries. Sedimentation ponds and diversion ditches would be constructed to eliminate runoff water carrying an increased load of suspended solids into the small tributaries draining the proposed mine area.

The effects of substrate blanketing by sediment and destruction of aquatic vegetation and invertebrates are of potential significance. Area streams are presently dominated by a benthic invertebrate fauna characteristic of fine-grained substrates. However, use of sediment control structures would prevent any massive blanketing of stream beds. Also, the fine-grained nature (e.g., sand, silt, and clay) of the substrates in the project area would ensure that no long-term alteration of substrate type would result, even if sedimentation rates were temporarily increased during construction activities. Therefore, any adverse impacts resulting from increased suspended solids loads to project streams are expected to be short-term and localized.

The immediate increase in leaching of soil nutrients commonly associated with clearing of vegetation could temporarily enrich streams in the project area. If this were accompanied by the clearance of riparian vegetation, etc., the increased nutrient and light levels would probably cause algal blooms in pool areas, when suspended solids concentrations are sufficiently low. Nutrient release rates from cleared areas would decrease following the initial pulse, and nutrient enrichment of project streams is not anticipated to be a long-term effect.

Transmission Lines and Natural Gas Pipeline

Adverse impacts on aquatic communities from construction of the proposed transmission line would include temporary erosion and sedimentation during clearing of the ROWs and by construction vehicles crossing streams. Fish may temporarily leave the areas of activity and some sedentary aquatic organisms may be temporarily reduced due to siltation. These impacts should be temporary and short lived, restricted to the period of construction at each stream crossing. Transmission line construction activities would adhere to TVA's (BMPs) Manual for Transmission Construction and Maintenance Activities (Muncy 1992), as well as TVA's ROW Clearing Specifications and Environmental Quality Protection Specifications for Transmission Line Construction (Appendix B-2). The impacts resulting from transmission line construction are therefore expected to be insignificant.

Construction of the natural gas pipeline would result in impacts similar to those resulting from transmission line construction. Additional impacts could result from trenching through Besa Chitto Creek if this construction technique is chosen. Appropriate BMPs would be required during construction of the natural gas pipeline, and the resulting impacts would be insignificant.

4.7.1.2 Operational Impacts

Generation Facility

The proposed generation facility is designed to minimize the use of water and to maximize its reuse throughout the plant systems. The facility would be designed for zero discharge of process water. Wastewater effluent from the different treatment streams would be collected and either sent to a brine concentrator where the solids would be extracted for disposal in a landfill or used to wet ash prior to placement in the ash management unit. The wastewater treatment system would consist of a magnesium oxide softener, reverse osmosis unit, and a demineralizer to produce all boiler makeup and service water requirements. As provided in the SWPP Plan, stormwater would be collected and directed to the

facility's stormwater pond. Discharge from this pond would be routed to a natural drainage. Discharge from the detention pond(s) would not exceed the rate of predevelopment discharge from the site. No adverse effects to aquatic communities are expected to occur as a result of generation facility operation. If a storm event exceeding the design specifications of facility site drainage impoundments were to occur, short-term degradation of the water quality of receiving streams could be expected. However, no potentially toxic water quality constituents of the proposed generation facility's discharge are expected to reach levels that would adversely affect aquatic communities of receiving streams.

Mine

Drainage systems affected by the proposed mine include portions of the watersheds of Little Bywy Creek, Middle Bywy Creek, Stewart Creek, and Besa Chitto Creek. Little Bywy Creek and Middle Bywy Creek are located in the immediate mine area and serve as the primary receiving streams for mine area runoff. Directly adjacent and east of the mine area is the watershed of Stewart Creek, and to the south is Besa Chitto Creek watershed. Little Bywy Creek, Middle Bywy Creek, and Stewart Creek all drain into Big Bywy Ditch, a major tributary of the Big Black River. The watershed of Big Bywy Ditch is bounded on the north by the watershed of Big Black River, on the east by watersheds of the Noxubee River, and on the south by the topographic divide between the Big Black River and Yockanookany River Basins. Disruption of normal flow volumes and patterns are expected until backfilling has been completed, with adverse impacts on aquatic life occurring in stream channels directly affected by proposed mining activities.

Disturbance of aquatic habitats during mine operation could result from the increased suspended solids loads entering the creeks, which would be a function of rainfall and subsequent surface water runoff. However, all of the runoff and other discharges along and within each mine block would be regulated by sedimentation ponds and diversions. Sedimentation ponds would provide detention of surface runoff from subbasins affected by the mining operation, as well as the detention of pit inflows from mine pit water control operations. The diversions would divert or detain runoff from subbasins not directly disturbed by mining activities.

Potential constituents of runoff from roads and service areas could include oil and grease deposited during operation of vehicles. Runoff from service areas and road surfaces would be controlled by sedimentation ponds or other BMPs.

It should be pointed out that activities such as land clearing and road construction, in addition to others which may be classified as construction, such as construction of embankments for diversion and sedimentation ponds, would continue throughout the life of the project as mining progresses. Therefore, it should be recognized that operational activities, like the construction activities, would not affect the entire project area simultaneously.

As prestripping operations begin in the first mine block, temporary stream diversions would be constructed, resulting in the loss of habitats and the aquatic life of the existing stream channels. Although the new channels can be expected to colonize rapidly, they are unlikely to provide the habitat

diversity of the natural channels. Extremes in water level (discharge) in new channels are expected to be greater than in natural channels because they would be straightened and because their watersheds would have reduced vegetative cover, at least in the short-term. Riparian vegetation would remain undisturbed in downstream reaches of affected streams.

Extensive removal of riparian vegetation from the streams of the mine site, and construction of new, unshaded diversion channels, would result in a change in the trophic structure of affected stream reaches. These streams are presently dominated by detrital food chains dependent on leaf litterfall from the surrounding woodlands. *In situ* production by algal and macrophytes is, at present, largely confined to areas, such as road crossings, that have been cleared. While extensive alterations in the abundance and composition of the algal and macrophyte flora can be expected, the effects on other components of the aquatic community are less clear, but are discussed further.

Zooplankton and littoral macroinvertebrate densities would probably rise due to increases in phytoplankton food availability and the additional cover provided by more extensive stands of aquatic vegetation. The factors affecting potential changes in the macroinvertebrate community are more complex. Although *in-situ* production would, to a large degree, supplement terrestrial organic material at the base of the food chain, it must be pointed out that the largest proportion of aquatic macrophyte production also enters the food web as detrital material, rather than being cropped when living. Detritus-feeding organisms (e.g., most oligochaetes) may be largely unaffected, as the source of organic material in the sediments appears to be unimportant relative to the amount available. Some changes may occur in the composition of the detritus-feeding fauna as the source of detritus changes from mainly terrestrial plant leaves to aquatic vegetation, but little is known about the dependence (or lack thereof) of these species upon specific detrital sources. Two groups of macroinvertebrates, the scrapers/algal grazers and filter feeders, can be expected to increase in abundance and diversity in response to these changes. Additionally, the increased habitat diversity provided by macrophyte stands could be expected to result in some increase in macroinvertebrate abundance and diversity. Fish species feeding on macroinvertebrates (e.g., sunfishes, catfish) would be affected by changes in invertebrate species composition and distribution only to the extent that the availability, or catchability, of prey items changed. For instance, the greater abundance and variety of invertebrates generally associated with aquatic vegetation could result in some increases in sunfish and top minnow populations.

Other factors attendant to the change from woodland to open stream habitat that could affect the fish community include increases in the ranges of variation in temperature and water level, and increased availability of cover in stands of vegetation. Increased summer temperature could have adverse impacts on fish population, while increased oxygen levels and cover provided by aquatic vegetation could have beneficial impacts.

...ugh offset ↓ from ...imp

The degree to which mining activities would alter the present streamflow regime cannot be accurately predicted. Ordinarily, clearing of forest cover would result in more rapid runoff, increased flood peaks, and extended low-flow periods. However, the large number of sedimentation ponds to be used would

substantially retard the runoff peaks and release the impounded water more slowly, somewhat approximating the hydrologic effects of the original forest cover.

Sedimentation ponds controlling runoff from disturbed areas could serve to concentrate a variety of discharge materials. These ponds are designed to treat mine discharge and other runoff by settling, and would be able to retain the concentrates during a 10-year, 24-hour storm. The potential exists for biomagnification of these materials (mainly heavy metals) in animals, especially waterfowl, using these ponds unless efforts are made to restrict use. However, the data obtained from the overburden cores suggest that concentrations of runoff materials such as arsenic, cadmium, chromium, copper, fluoride, molybdenum, selenium, and uranium from disturbed and undisturbed areas would be insignificant.

'orig[illegible] w/ sampling

Potential adverse impacts to aquatic communities could include drainage of acidic, metal-bearing waters from exposed overburden piles made up of materials having a high acid-forming potential, which would only occur when the unoxidized portions of the overburden material are exposed. With contemporaneous reclamation, the impact would be short-term, and any acid-forming materials in the exposed unoxidized overburden at the proposed mine would be offset by the presence of neutralizing agents such as alkali salts and clay minerals. Therefore, acid mine drainage is not expected to occur.

Reclamation – Reconstructed stream channels would be of sufficient width to allow the natural processes of weathering and sedimentation to shape a meandering channel. To the extent possible, the preexisting stream drainage configuration would be retained and slopes similar to premining conditions would be achieved to facilitate streamflow regimes consistent with premining rates. Several wetland/aquatic wildlife enhancement areas would be restored adjacent to drainages, so beneficial impacts would result from the additional acreage of created fish and wildlife features, as detailed in the reclamation plan contained in the mine permit application.

Revegetation efforts would be directed to stabilize slopes, control erosion, and provide initial stages of a high quality wildlife habitat. Channels and associated side slopes would be planted to grass and legume species capable of tolerating streamflow with minimal erosion. Shrubs and tree species which provide superior food, cover, and shelter for wildlife would be planted along channels and around the wetland/aquatic wildlife habitat enhancement areas.

No attempt would be made to artificially restock stream sections because of their ephemeral or intermittent nature. Natural restocking of plankton and invertebrate species would occur, and fish would move principally from downstream areas to occupy the recreated habitat. Following completion of mining, stocking of the ponds and lakes would be employed as necessary to maintain or enhance their fishery value. Although fish stocking depends on landowner goals and management philosophy, the most commonly stocked fish in Mississippi farm ponds are channel catfish, largemouth bass, bluegill, and redear sunfish. Ponds and lakes stocked with these species, and properly managed, would provide a stable fisheries resource.

Transmission Lines and Natural Gas Pipeline

Operation and maintenance of the transmission line and natural gas pipeline could result in adverse impacts to aquatic life. Periodic reclearing of vegetation along the ROW utilizes significant buffer zones between reclearing activities and streams, wetlands, and other water bodies. Tree removal may have long-term, but localized effects on aquatic ecosystems at stream crossing sites. These effects would include elevated temperatures, increased solar insolation, and increased phytoplankton production. Rooted aquatic plants could also become established in areas where tree canopy would be permanently removed. Use of BMPs for utility corridor maintenance and TVA's ROW specifications would help minimize these impacts. The Town of Weir has indicated that it would require its gas pipeline contractor to use BMPs and other good industry practices.

4.7.1.3 Combined Impacts of Generation Facility and Mine

The combined effects of construction and operation of the generation facility, mine, and associated facilities on the aquatic communities of the project area include the removal (until backfilling is completed) of some upland, ephemeral, intermittent, and perennial stream habitats; disturbance of some habitat parameters in the lower reaches of project area streams; creation of pond habitat; and fluctuations in resident species population sizes and distributions. Population fluctuations are expected to be apparent, as local decreases in some fish and larval insect species and as local increases in chironomids, oligocheates, vascular aquatic plants, and certain algal and microbial species. A short-term minor net loss in the aquatic energy base may occur as the food chain base shifts from a dependence on leaf litterfall to a dependence on algae and macrophytes. The minor net loss in the aquatic energy base is expected to be regained as the system stabilizes.

4.7.2 No Action Alternative

Under the No Action Alternative, aquatic ecology would be unchanged from its present condition. Additional stormwater runoff, sedimentation, process wastewater or sanitary wastewater could result from routine area development (e.g., industrial, commercial, or housing development). However this growth would be slow and incremental, and impacts to aquatic ecology would likely be insignificant. If TVA does not purchase the electric power generated by the Red Hills Generation Facility of the project, the potential impacts range from none to about the same as described previously if the project proceeds.

4.8 Wetlands

4.8.1 Action Alternative (Project as Proposed)

4.8.1.1 Construction Impacts

Generation Facility

The major generation facility construction activity with the potential to impact wetlands is clearing and grading for roads, buildings, the ash management unit, and other facility components. As described in Section 3.8.2, 27 wetlands totaling 11.94 acres occur on the generation facility site. Sixteen of these wetlands would be avoided. Impacts would occur to the remaining 11 wetlands (totaling 3.58 acres), and an additional 0.90 acre of intermittent stream channels. Table 4.8.1.1-1 describes specific wetland impacts. Numbers in the table correspond to wetlands mapped on Figure 3.8.2-1.

Table 4.8.1.1-1 Breakdown of Wetland Impacts

Wetland	Wetland Type	Acres Impacted	Proposed Structure	Proposed Activity
1	palustrine shrub/scrub	0.04	Parking Lot	Fill
2	palustrine shrub/scrub	0.02	Parking Lot	Fill
3	palustrine emergent/shrub/scrub	0.01	Parking Lot	Fill
13	palustrine forested	0.11	Building/Road	Fill
15	palustrine emergent	1.39	Building/Road	Fill
16	palustrine emergent	0.22	Building/Road	Fill
23	palustrine emergent/shrub/scrub	0.31	Ash Storage	Fill
24	palustrine forested/shrub-scrub	0.34	Ash Storage	Fill
25	palustrine forested	0.10	Sediment Pond	Fill/Flood
26	palustrine open water	0.89	Sediment Pond	Dredge/Flood
27	palustrine emergent	0.15	Sediment Pond	Fill/Flood
Total		3.58		

All proposed wetland impacts would be subject to the requirements of an Individual Section 404 permit granted by the US Army Corps of Engineers and Section 401 Certification. The following actions would help reduce or offset potential wetland improvements:

- conversion of 5.4 acres of upland areas into wetlands by restoration of hydrology and wetland vegetation,
- purchase and preservation of a 15-acre forested wetland within the Besa Chitto Creek watershed, and
- preservation of wetland #20 (Figure 3.8.2-1), a 4.3-acre pristine forested area located on the eastern boundary of the project site.

Even with the mitigation plan, some loss of habitat functions would occur, during the time nursery stock planted in the mitigation site develops into a mature mosaic of wetland vegetation. Wetland functions would be expected to return over time as natural revegetation and succession occurs and wetland hydrology is restored. With the implementation of a mitigation plan, the impacts on wetlands resulting from generation facility construction would be insignificant.

Mine

Mine construction actions potentially impacting wetlands include clearing and grading for the support facilities, the initial overburden disposal areas, and haul roads, as well as the initial overburden removal, stream rerouting, and sedimentation pond construction. As with wetlands impacted by construction activities associated with the generation facility, mitigation would be completed in accordance with US Army Corps of Engineers Section 404 Nationwide Permit Section 21 requirements and specific details included in the mine permit application (MLMC 1997). Options for mitigation consist of offsite mitigation of wetland impacts, onsite mitigation located in the mine area, or a combination of both. Offsite mitigation could consist of purchase and restoration of wetlands converted to croplands. These areas would be selected with input from Natural Resource Conservation Service based on the existence of hydric soils, and would be replanted in wetland vegetation and allowed to revert to wetland systems. Specific sites and mitigation ratios have not yet been determined. Onsite wetland mitigation would be accomplished through regrading of spoils to appropriate contours, replacement of suitable wetland soils, and planting wetland vegetation. Even with mitigation, a loss of wetland functions would occur for the period of time required for the mitigated wetlands to mature. Wetland functions would be expected to return over time, as natural revegetation and succession occurs and wetland hydrology is restored. Overall impacts of mine construction on wetlands would be insignificant.

Transmission Line and Natural Gas Pipeline

Photointerpretation of aerial photography identified 185 acres of wetlands in transmission line Corridor A. Based on trends elsewhere in the region, it is likely the amount of wetland acreage within Corridor A is much lower than the aerial photography indicates. NWI maps indicate that the non-overlapping portion of Corridor B crosses one narrow palustrine scrub-shrub wetland and five palustrine forested wetlands. Due to the topography of this route, age of NWI maps, and subsequent land use

changes, it is likely total wetland acreage affected within this corridor would be less than ten acres. The natural gas pipeline corridor crosses two palustrine forested wetlands.

Field surveys would be conducted along the transmission line corridors and natural gas pipeline corridor during the spring of 1998 to ground truth the aerial photography and presence of wetlands. Results of these surveys will be described in the Final Environmental Impact Statement and would be used to route the transmission line to avoid wetlands to the extent possible if the project proceeds.

Wetland impacts resulting from utility construction are regulated by Section 404 requirements. In the case of TVA transmission lines, Executive Order 11990 – Protection of Wetlands, must also be considered. Construction of the transmission lines and natural gas pipeline would require clearing of tall growing vegetation and in the case of the pipeline, temporary removal of soils. These activities would be performed in accordance with applicable wetland permits, using erosion and sedimentation BMPs as described by Muncy (1992). Examples of procedures that could be employed include using swamp mats or wide track equipment, segregating topsoil, installing erosion and sedimentation control measures or devices, limiting the area of disturbance, returning the area to preconstruction contours, and promoting revegetation. Implementation of these procedures would minimize indirect impacts to wetlands.

Construction would diminish the recreational and aesthetic values of the wetlands crossed by the proposed facilities. These effects would be greatest during, and immediately following, construction of the transmission line and natural gas pipeline. In emergent wetlands, the impact of construction would be relatively brief, as herbaceous vegetation would regenerate quickly. In forested and scrub-shrub wetlands, the impact would be of longer duration because woody vegetation would be periodically recleared to maintain National Electrical Safety Code clearances.

4.8.1.2 Operational Impacts

Generation Facility

Operation and maintenance of the generation facility is not expected to have any significant impacts to wetlands in the project area.

Mine

The mine permit area includes the entire 37-year life of the RHLM. This area includes mined areas as well as ancillary structures such as roads and sedimentation ponds. Within the entire mine area there are approximately 63 acres of wetlands, not all of which would be directly impacted by mining activities. In the mined areas, land clearing for overburden and lignite removal would remove wetland vegetation and soil, and alter drainage patterns and wetland hydrology. Table 4.8.1.2 describes wetland acreages impacted in five-year mining intervals.

Table 4.8.1.2-1 Wetland Acreage by Five-Year Intervals		
Years	Wetland Type	Acres Impacted
1-5	palustrine forested	5.4
5-10	palustrine forested	9.3
	palustrine emergent	0.3
11-15	palustrine forested	9.2
	palustrine emergent	0.9
	lacustrine emergent	1.5
16-20	palustrine forested	5.3
	palustrine emergent	4.3
21-25	palustrine forested	3.9
	palustrine emergent	2.7
26-30	palustrine forested	2.8
	palustrine emergent	2.5
31-35	palustrine forested	10.1
	palustrine emergent	3.1
36-37	palustrine forested	1.1
	palustrine emergent	0.7
	TOTAL	63.1*
*Due to rounding and resolution of GIS coverages, there is a 0.7 acre difference in total acreage from field surveys.		

Specific mitigation plans for the mine area are being developed by MLMC in conjunction with issuance of the COE Nationwide Section 21 permit. Mitigation options, developed with input and guidance from COE regulatory personnel, consist of offsite mitigation of wetland impacts, onsite mitigation located in the mine area, or a combination of both. Offsite mitigation would consist of purchase and restoration of wetlands converted to croplands. These areas would be selected with input from the NRCS based on the existence of hydric soils, and would be replanted in wetland vegetation and allowed to revert to wetland systems. Specific sites and mitigation ratios have not yet been determined. Onsite wetland mitigation would be accomplished through regrading of spoils to appropriate contours, replacement of suitable wetland soils, and planting wetland vegetation. Even with mitigation, a loss of wetland functions would occur for the period of time required for the mitigated wetlands to mature. As wetland vegetation develops and matures, wetland habitats and functions would improve, and wildlife are expected to return to the mined areas. Therefore, impacts to wetlands would be insignificant. Creation of additional wetlands could result in beneficial impacts.

Some loss of wetlands that have developed around small springs and seeps in the mine area would occur. These wetlands have developed due to perched groundwater formed by relatively impermeable lenses of clayey material beneath sandy layers. Replacement of the overburden materials during mining would result in a more uniform permeability that could minimize reestablishment of perched groundwater conditions and associated wetlands.

Transmission Line and Natural Gas Pipeline ROW Maintenance

Maintenance of the natural gas pipeline ROW would entail mowing, performed semiannually or more frequently, as determined by the local utility company. Vegetation on the ROW would not be allowed to grow to a height greater than three feet. Consequently, any forested wetlands in the pipeline ROW would be converted to emergent or scrub-shrub wetlands.

Woody vegetation in the transmission line ROW would be periodically cleared using mechanical equipment, herbicides approved for use near water, or hand clearing. No significant adverse effects are expected to occur as a result of maintaining the ROW. Since the area would be limited to areas where woody vegetation persists, maintenance would be infrequent, and natural herbaceous vegetation would remain. However, some long-term conversion from palustrine forested to palustrine scrub-shrub or emergent wetland would be expected to occur, as a result of ROW maintenance.

4.8.1.3 Combined Impacts of Generation Facility and Mine

The combined impacts of the generation facility and the mine would include the permanent loss of up to 67 acres of existing wetlands and their associated wetland functions. This loss would be mitigated by appropriate activities, as described in Sections 4.8.1.1 and 4.8.1.2, under the oversight of COE. As wetland mitigation projects are completed throughout the life of the project, some net increase in wetland resources would result.

4.8.2 No Action Alternative

Under the No Action Alternative, some losses of wetlands would be expected to occur as the result of conversion to upland urban, suburban, industrial, and agricultural land uses in the area. Such future impacts from routine area development would be handled on a case by case basis through COE permitting requirements. However, in the event the generation facility and mine were built and operated independent of TVA's involvement, impacts to wetlands would be expected to be similar to those described in this EIS.

4.9 Floodplains

4.9.1 Action Alternative (Project as Proposed)

The provisions of Executive Order (EO) 11988 Floodplain Management must be addressed when the proposed development is considered. Repetitive actions (e.g., underground or overhead utility lines and support structures, public highways, parking lots) are approvable provided adverse impacts are minimized. For nonrepetitive actions, EO 11988 states that all proposed facilities should be located outside the limits of the 100-year floodplain unless alternatives are evaluated which would either identify a better option or support and document a determination of "no practicable alternative" to siting within the floodplain. If this determination can be made, adverse floodplain impacts should still be minimized during design of the project.

For a "critical action," facilities should be protected to the 500-year flood elevation where there is no practicable alternative. A "critical action" is defined in the Water Resource Council Floodplain Management Guidelines (43 FR 6030 1978) as any activity for which even a slight chance of flooding would be too great. One of the criteria used in determining if an activity is a critical action is whether essential and irreplaceable records, utilities, and/or emergency services would be lost or become inoperable if flooded. Based on this criterion, portions of the generation facility would be considered as "critical actions" because flooding of these facilities would render them inoperable.

4.9.1.1 Construction Impacts

Generation Facility

Construction of the generation facility would involve the siting of several roads and the stormwater detention pond within the limits of the 100-year floodplain of a small tributary to Besa Chitto Creek. The limits of the approximate 100-year floodplain are shown on Figure 3.9-1. In terms of EO 11988, the access roads and the stormwater detention pond would be repetitive actions in the floodplain. Adverse impacts would be minimized by designing and constructing these facilities to withstand flooding with minimum damage, by using BMPs during construction, and by constructing these facilities so they would not increase upstream flood elevations by more than one foot. All other portions of the generation facility would be located at about elevation 560, which is well above the approximate 500-year flood elevation. The ash management unit would involve siting in the upstream areas of some small intermittent streams. Normal site drainage techniques would control any potential flood problems from these streams.

Mine

The mine would be located in an area where there are several small intermittent streams along with two larger streams, Little Bywy Creek and Middle Bywy Creek. As discussed in Section 2.2.2, alternative mining techniques that would not adversely impact floodplain areas have been evaluated. There appears to be "no practicable alternative" to using surface mining techniques to remove the lignite from this area. During development of the mine, many streams would be diverted and routed to sedimentation ponds. Undisturbed runoff would be diverted around mining blocks. Detention of water in the sedimentation ponds would alter natural flood flows by lowering the peak and delaying the downstream flows. The annual volume of treated water released from the sedimentation ponds should be equivalent to the annual natural runoff. The impact of reclaimed topography would be minor because hydraulic lengths, gradients, and conveyances of existing channels would not be materially affected (MLMC 1997). These efforts would help to lessen impacts to upstream flood elevations. By returning affected areas to their premining condition during reclamation, adverse floodplain impacts would be minimized consistent with the requirements of EO 11988. The mine support facilities (shop/warehouse, office) would be located well above the anticipated 100-year flood elevation.

Transmission Line and Natural Gas Pipeline

The transmission line and natural gas pipeline would involve construction in the floodplain. Both of these activities are considered to be repetitive actions in the floodplain. To minimize adverse impacts, the natural gas pipeline would be constructed completely underground and the impacted area would be returned to preconstruction conditions. The construction of the supporting structures for the transmission line would not be expected to result in any increase in flood hazard, either as a result of increased flood elevations or changes in flow carrying capacity of the streams being crossed. To minimize adverse impacts, the ROWs would be revegetated where natural vegetation is removed. BMPs would be used during both of these construction activities.

4.9.1.2 Operational Impacts

Generation Facilities

All facilities associated with the generation facility, would be located above the 100-year flood elevation at that location. Those considered "critical actions" would be located well above the 500-year flood elevation at that location. Therefore, operation of these facilities would not be adversely impacted by flooding.

Mine

All facilities associated with the mine would be located above the 100-year flood elevation. Surface mining operations would not be adversely impacted by flooding because many streams would be diverted and routed to sedimentation ponds and undisturbed runoff would be diverted around mining blocks. Most of the equipment used in the mining operations would be mobile and could be relocated in advance of a large flood event to prevent damage to the equipment.

Transmission Line and Natural Gas Pipeline

There would be no anticipated impacts from the operation of the transmission line or natural gas pipeline because these facilities are either elevated well above the 100-year floodplain (transmission line) or are located underground (natural gas pipeline).

4.9.1.3 Combined Impacts of the Generation Facility and the Mine

All anticipated impacts resulting from the construction and operation of the generation facility and the mine have been covered in Sections 4.9.1.1 and 4.9.1.2.

4.9.2 No Action Alternative

Under the No Action Alternative TVA would not purchase power from the RHGF and would not construct a transmission line. If the generation facility and mine were not built, the existing floodplain conditions in the areas where these facilities would be located would remain unchanged from their current condition. However, in the event the generation facility and mine were built and operated independent of TVA's involvement, impacts to floodplains would be expected to be similar to those described in this EIS.

4.10 Terrestrial Ecology

4.10.1 Action Alternative (Project as Proposed)

4.10.1.1 Construction Impacts

Generation Facility

Site preparation and construction activities would result in vegetation removal from much of the 390-acre generation facilities area. This area would include the facility island, runoff ponds, ancillary access roads, an ash management unit, ash haul road, water pipeline, lignite storage, overland conveyor, and construction parking areas. The loss of this amount of common plant communities (see Table 3.10.1-3) would not be important from a state or regional perspective. Impacts to some deep ravine habitats may occur during construction.

Construction of the generation facility and associated roads and excess material disposal would have direct impacts on terrestrial wildlife, mostly in the form of removal of habitat. Mobile species, such as large mammals and birds, would migrate out of the area. However, smaller organisms such as small mammals, amphibians, and reptiles, as well as their habitat, would be destroyed. These would be temporary impacts, but could be important locally. Many of the impacted habitats could be reclaimed. Small wetlands would be created adjacent to the facility to offset losses of existing wetlands. This could result in a net increase in wetlands in the area, and in turn, would result in a increase of riparian habitats in the vicinity.

Indirect impacts to terrestrial ecosystems might result from the influx of workers and the resulting increase of development in the region. This would result in a increase in hunting pressure in the area and a loss of wildlife habitat. However, the existing recreational facilities would be able to absorb these increases, as discussed in Section 4.20, and such indirect development is expected to be limited. Road fatalities of wildlife would be expected to increase due to this increase of workers and the associated increase of automobile traffic in the area.

Mine

Site preparation and construction activities would result in vegetation removal from most of the mine facility construction areas. These areas include the access roads, water control structures, lignite transport roads, and mine support facilities, such as shop and warehouse building, offices, parking areas, fuel tank farm, vehicle wash area, and dragline erection site. All of the approximately 300 acres that would be affected by mine facility construction activities would have the existing vegetation removed. These impacts would not be important from a state or regional perspective.

Construction of the mine would destroy most habitat suitable for wildlife in the immediate vicinity of the mine and would have impacts similar to the construction of the generation facility. This would result in the migration of more mobile species of wildlife out of the area. Some habitat would be converted into industrial areas, such as offices and parking lots, for the life of these facilities.

Transmission Line and Natural Gas Pipeline

Based on inspections of the proposed natural gas pipeline route from the highway and secondary roads, much of the route appears to have been impacted by repeated timber removal. In addition, exotic plant species adjacent to existing railroad and road ROWs have encroached upon and/or replaced native vegetation. It is not expected that species or communities of state or regional significance would be encountered along the proposed natural gas pipeline route.

The general vegetation of the two identified transmission line routes is similar, although selection of Corridor A would require the removal of less forest. Corridor B offers greater potential for the occurrence of uncommon plant communities and rare plants. In particular, several sites were seen that might have mesic ravines, an uncommon plant community.

Use of Corridor B would significantly impact the Mabus Family Natural Area. Transmission line construction and operation would destroy a substantial portion of this undisturbed, mature forest. This would eliminate the ecological value of this natural area. However, the Elmer E. Mabus Memorial Natural Area would not be impacted by construction or operation of the transmission line in Corridor B.

The construction of utility lines would result in the conversion of some forested habitats into early successional habitats. This would result in fragmentation of these habitats along the length of the corridor. While the creation of edge can be beneficial to some species of wildlife and result in an increase in diversity along a corridor, it can negatively impact nesting neotropical migrants and resident songbirds by resulting in an increase in nest parasitism. Nest parasitism is a process where some species of birds, such as cowbirds, deposit their eggs into the nest of another species of bird, leaving the "surrogate" parent to raise the cowbird young. Nest parasitism can have serious negative impacts to local songbirds and has been implicated in the decreasing numbers of some species of neotropical migrants. Of the two powerline corridor options, Corridor A utilizes existing corridors, for the most part, resulting in far less fragmentation of forested habitat in comparison to Corridor B. Therefore the use of Corridor A would have less of an impact on terrestrial wildlife.

Erosion can take place when constructing utility lines in the vicinity of woodland streams, resulting in the degradation of stream quality. This would have negative impacts on many types of salamanders and other riparian species of wildlife. The use of BMPs, including silt screens, would minimize such potential impacts.

4.10.1.2 Operational Impacts

Generation Facility

Operation of the generation facility is expected to have no significant impacts on the vegetation of the project area or region.

Impacts from the operation of the generation facility would result from noise generated at the facility. Noise could disrupt breeding in some species of birds and would cause some wildlife to move from the vicinity. However, many species of wildlife would quickly acclimate to noise and would not be impacted by the operation of the generation facility.

Mine

Operation of the mine would essentially remove most of the current vegetation on the mine site. Forests owned by private landowners could be cleared several years before mining of a particular tract due to the anticipation of the mining. On other tracts owned or controlled by the mine, the existing vegetation would remain in its present condition until immediately prior to overburden removal. All vegetation would be removed from about 127 acres each year, in advance of lignite removal. Following lignite removal, the mine pit would be backfilled, the site regraded to approximate the original contour, and then revegetated. Because the original soil seed bank and any stumps capable of resprouting would have been eliminated, the revegetated community during the early years of reclamation would largely be determined by the replanting process. Species proposed for use during replanting are listed in Appendix B-1, as well as the mine permit application (MLMC 1997). The plant species diversity of the reclaimed lands would initially be lower than premining conditions, some premining plant communities would be eliminated, and the proportions of major vegetative cover types would be altered.

The type of plant cover restored during reclamation is at the discretion of the surface landowner. Based on landowner preferences, most of the mine would likely be restored to loblolly pine, interspersed with fish and wildlife features. This would result in a local reduction in the mature hardwood and hardwood-pine community types, continuing and possibly accelerating a regional trend (Hartsell and London 1995). Plant succession in areas reclaimed as pine plantations would likely follow trends in commercial pine plantations following clear cutting and site preparation, with grasses and forbs dominating during the first five to ten years, until the pines become large enough to shade out the under story. At this time, plant species diversity could decrease markedly. Compared to commercial pine plantations, plant species diversity would be low, especially in areas in the interior of the mine distant from sources of wind- or animal-transported seeds.

Of greater significance are potential impacts to uncommon plant communities. Mining would destroy one mature deciduous forest community. The loss of this stand would be locally important but not from a state or regional perspective. As originally proposed, mining near the northern end of Mine Area 1, during about year 27 of mine operation, could destroy two other unique communities: a cactus community and a rich spring-head seepage area. The cactus community is of state and regional significance. Because of the assemblage of amphibians found in the spring-head seepage area, it is also of state significance. MLMC has committed to either mitigate the loss of these communities through relocation or transplantation of suitable habitats or avoid mining through these areas to the extent practicable. If it is determined that avoidance is the appropriate measure, it is recognized that subsurface hydrology would be a principal factor in determining the width of buffer required and MLMC would commit to further analyses of this when appropriate in the future. A buffer of at least 200 ft would be required to protect the communities from disturbance associated with clearing of the surrounding canopy and opening the communities to increased sunlight and invasion by exotic species.

Operation of the mine would also substantially impact site wildlife populations. Existing wildlife habitats would be eliminated by mining operations at an average rate of 127 acres/year. Following lignite removal, mine pits would be quickly reclaimed and revegetated. Although most of the area would likely be reclaimed to pine plantation interspersed with fish and wildlife features and grasslands, local wildlife species using mature hardwood and hardwood-pine forests would likely be lost from the site. This would impact many species including some neotropical migrant birds such as the yellow-billed cuckoo, great crested flycatcher, and wood thrush (species of high regional concern).

Wildlife populations in the pine plantations would likely reach their highest animal species diversity and abundances during the first decade after reclamation, and resemble those in commercial pine plantations (Atkeson and Johnson 1977, Dickson and Segelquist 1979, Dickson et al. 1995). Because of the simpler vegetative structure on the reclaimed mine areas, however, wildlife species numbers and diversity would likely be lower than those on commercial pine plantations. The mosaic of grasslands and plantations resulting from reclamation would also have a high edge to area ratio and increased nest predation and nest parasitism.

The increased area of pine plantations with relatively low structural and plant species diversity could reduce the quality of white-tailed deer and wild turkey habitat, primarily through the loss of hardwood mast. Impacts to turkeys would likely be greater than those to deer. Recent studies of commercial, short-rotation pine plantations in the region suggest that the reclaimed mine areas would continue to support huntable populations (Hurst and Dickson 1992, Miller et al. 1995). Experience at other mine locations indicate these species would quickly return to the area.

Mining operations, however, would benefit many wildlife species using early successional grassland and shrub habitats by providing a continuous supply of these habitats throughout the life of the mine. Species which would benefit include eastern cottontail, several small mammals, the red-tailed hawk, northern bobwhite eastern bluebird, eastern towhee, eastern meadowlark, fence lizard, and speckled kingsnake. It

would also benefit some migratory and permanent resident birds of regional concern, such as the loggerhead shrike, prairie warbler, and field sparrow.

Impacts to wetland wildlife, however, would be mitigated as wetlands are restored. The sedimentation ponds would also provide additional wetland and open water habitats for at least the life of the mine, or longer, if retained permanently. These would result in an increase in open water habitats in the area, and provide habitat for mammals, such as the muskrat and raccoon, wading birds, waterfowl, and several species of reptiles and amphibians.

Impacts to some wildlife species could be mitigated through specific reclamation practices such as establishment of wildlife food plots, planting groves of mast- and fruit-bearing trees and shrubs. These practices would most benefit seed- and fruit-eating species using early successional habitats. Strips of hardwoods could also be planted along streams, increasing the habitat diversity and, once they mature, providing travel lanes for several species. Most of these wildlife mitigation practices, however, would be of limited benefit to many species requiring late successional, forested habitats. Such wildlife mitigation practices would be carried out in consultation with Mississippi Department of Wildlife, Fisheries, and Parks biologists and other wildlife professionals.

Transmission Line and Natural Gas Pipeline

Maintenance of the selected transmission line and natural gas pipeline ROW would result in the perpetuation of early successional plant communities. The existence of these communities is not expected to have state or regional importance. Uncommon plant communities would likely not be affected.

Maintenance activities of utility ROWs would result in the perpetuation of early successional habitats along the length of the line. This would favor early successional species of wildlife. Several of the game birds were found to be most common along utility corridors already existing in the project area. Maintenance activities could lead to increased sediment loads into streams in the area due to erosion. This erosion would be minimized with the establishment of riparian buffer zones along streams that flow across any utility ROW. These buffer zones would also establish travel corridors for species of wildlife that may be reluctant to cross utility corridors. Additionally, establishment of streamside buffer zones would result in an increase of habitat diversity along the corridors.

Impacts to wildlife from the maintenance of utility corridors could be minimized if wildlife food plots were established along the corridors. If this were not feasible, herbicide regimes used to maintain early successional habitats along corridors would be adjusted to favor the establishment of vegetation most favorable to wildlife. These vegetation types include bunch grasses, forbs, and shrubs such as sumac. This would provide a variety of foraging, loafing, and nesting sites for wildlife along the utility corridors.

4.10.1.3 Combined Impacts of Generation Facility and Mine

Because the extent of disturbance due to mining activities would be greater than that of the generation facility, the combined impacts of the two activities on the local vegetation is scarcely more than the

impacts of the mine alone. The loss of this amount of common habitat is not expected to have negative impacts to the vegetation of the state or region. The uncommon habitats are not expected to reoccur, if eliminated by mining.

The construction and operation of the generation facility and the mine would result in the disruption of plant communities and wildlife populations, but over a 37-year period. Some losses could include small stands of American beech, bottomland hardwoods, riparian zones, several small creeks, and seepage areas on project lands, if avoidance is not possible. Impacts to wildlife would be large-scale, but mostly short-term. Reclamation activities would be quickly implemented and mitigation efforts for the loss of wetlands would begin concurrent with initial construction. Some wildlife species from the surrounding area would begin utilizing the site once reclamation activities are initiated, because the area would serve as a sanctuary protected from hunting. Over time, the diversity of plants and animals would increase in the reclaimed areas. However, it would be many years before the plant and animal communities would return to premining conditions.

4.10.2 No Action Alternative

Under the No Action Alternative, impacts to the vegetation of the project area are expected to continue as they have in recent decades. Timbering and conversion to grassland or row crops are expected to continue. This would not result in significant changes to the existing pattern of vegetational cover although it would result in the occasional loss of uncommon plant communities. The Mabus Family Natural Area and the Elmer E. Mabus Memorial Natural Area would probably continue under current natural area stewardship.

Impacts to wildlife are expected to be minimal under the No Action Alternative. Because of the current demand for wood fiber in the project area, the large-scale clearcutting of forested habitats would likely continue. As new stands of trees are established, forests would return. However, current forestry practices in the vicinity would likely result in the conversion of hardwood and mixed-hardwood stands into pine forests. This land use would favor species of wildlife, mostly early successional species, that can withstand habitats that are often disturbed.

If TVA does not purchase the electric power generated by the generation facility, some other entity might buy the power and the project could proceed. In such an event, impacts similar to those described in this EIS would likely result.

4.11 Threatened Or Endangered Species

4.11.1 Action Alternative (Project as Proposed)

4.11.1.1 Construction Impacts

No plant or animal species federally-listed as threatened or endangered, or proposed for such listing, occur within or near the site of the generation facility, mine, transmission lines and natural gas pipeline, or within potentially impacted stream reaches downstream of the site. Construction of the project would therefore have no effect on federally-listed species or species proposed for such listing.

Generation Facility

The only state-listed species on the generation facility site is ginseng. Wild populations of this species are commercially-harvested in Mississippi, and the loss of the single population on the facility site would not be an important impact. To the extent practicable, however, CGI would transplant this ginseng population to a safer area prior to beginning construction activities. No listed aquatic species occur in stream reaches potentially affected by construction activities.

Mine

Construction of the mine support facilities could result in the loss of six state-listed rare plant species populations currently found on the site. Loss of these populations could result in some reduction in genetic diversity for the species. Such potential impacts could be mitigated by either avoiding the areas where listed plants occur or by transplanting or relocating the plants to other suitable sites in the area, except for the swamp hickory, as described in the mine permit application (MLMC 1997).

Because no known populations of state-listed animal species occur within the mine construction area, impacts to these species would be considered minimal. One state-listed fish, the chestnut lamprey, occurs in Big Bywy Ditch downstream of the proposed mine. As indicated in Sections 4.6.1 and 4.7.1, mine construction activities in the Middle Bywy Creek and Little Bywy Creek watersheds would not result in discernible impacts in the section of Big Bywy Ditch where the lamprey was found.

Transmission Lines and Natural Gas Pipeline

Construction of the proposed transmission line and natural gas pipeline is not anticipated to have impacts to state-listed plants, terrestrial animals, or aquatic animals. Intensive field surveys of the proposed utility corridors are usually conducted after the actual corridors are staked out to confirm preliminary determinations. However, based on the habitat types present and results of surveys elsewhere in the RHPP area, the presence of listed species is unlikely. If any listed species are found during field surveys to be conducted in the spring of 1998, the utility lines could either be rerouted to avoid impacts or other suitable mitigation employed.

4.11.1.2 Operational Impacts

No plant or animal species that are federally-listed as threatened or endangered, or proposed for such listing, occur near or within the site of the generation facility, mine, transmission lines, and natural gas pipeline, or within potentially impacted stream reaches downstream of the site. Operation of the project would therefore have no effect on any federally-listed species or species proposed for such listing.

Generation Facility

The operation of the generation facility is not expected to result in any additional impacts to state-listed plants or animals beyond those occurring during construction activities.

Mine

Operation of the lignite mine could impact up to 11 populations of the six species of state-listed plants occurring on the mine site. Loss of these populations could result in some reduction in genetic diversity for the species. The preferred method of mitigating these impacts would be to avoid mining the areas where these plants occur. This avoidance would, however, likely be impracticable. Most of the populations would not be impacted until relatively late in the life of the mine, and the MLMC could, in the meanwhile, develop other methods to mitigate such potential impacts.

Although no state-listed terrestrial animals are known to occur in the mine operations area, potential habitat for the Bachman's sparrow, mole kingsnake, and Webster's salamander could be impacted. Impacts to the sparrow and kingsnake habitat would be temporary, and suitable habitat could be restored during mine reclamation. If restoration of suitable habitat for Webster's salamander is unsuccessful; impacts to the species as a whole, however, would be insignificant.

One state-listed fish, the chestnut lamprey, occurs in Big Bywy Ditch downstream of the proposed mine. As indicated in Sections 4.6.1 and 4.7.1, mine operation activities in the Middle Bywy Creek and Little Bywy Creek watersheds would not result in discernible impacts in the section of Big Bywy Ditch where the lamprey was found.

Transmission Line and Natural Gas Pipeline

Operation of the transmission line and natural gas pipeline are not expected to have impacts to state-listed plants and animals beyond those occurring during construction activities.

4.11.1.3 Combined Impacts of the Generation Facility and Mine

Construction and operation of the generation facility and mine would impact several populations of state-listed plants. Measures to mitigate these impacts are described in the preceding paragraphs, and long-term impacts would be insignificant. Similarly, no significant combined impacts to state-listed terrestrial animals or aquatic species are anticipated.

4.11.2 No Action Alternative

Under the No Action Alternative, populations of state-listed rare plants would continue to exist on the site, subject to potential destruction by forest management activities and other significant land disturbing actions. No noticeable impacts to state-listed terrestrial animals or aquatic species are anticipated. In the event the generation facility and mine were to be developed independent of TVA's involvement, activities and potential impacts to threatened or endangered plants and animals would be expected to be similar to those described in this EIS.

4.12 Land Use

Current land uses in Choctaw County and in the vicinity of the proposed action are described previously in Section 3.12. This section addresses the potential impacts to these current land uses from the implementation of the proposed action, i.e., the construction and operation of the proposed generation facility and mine. Both potential construction and operational impacts of the proposed generation facility, mine, and associated activities were analyzed and are discussed below.

4.12.1 Action Alternative (Project as Proposed)

The proposed project involves the construction and operation of an electric generation facility, a lignite surface mine, a transmission line, and a natural gas pipeline. In some instances, these activities would result in permanent changes in land use; in others, changes in land use would be of a temporary nature.

4.12.1.1 Construction Impacts

<u>**Generation Facility**</u>

Construction of the generation facility and its ancillary facilities as described in Section 2.2.1 would directly affect land use on about 390 acres (see Table 4.12.1.1-1 and Figure 2.2.1.3-1). The generation facility itself would require approximately 170 acres, and the ash management unit would occupy about 150 acres. Within the ash management unit, about 90 acres would be used for ash storage and handling facilities, while about 60 acres would be used for buffers and ancillary uses (e.g., roads).

Construction activities would likely require extensive earth-moving operations to prepare the site for the proposed facilities, including buildings, structures, roads, work areas, and parking areas. The remainder of the generation facility site, about 70 acres, would likely be left relatively undisturbed to serve as a buffer. However, in terms of land use, the entire 390-acre site would be converted to industrial use, precluding other uses of the site for the life of the facilities.

Forestry represents the predominant land use category (about 320 acres), and most of this would be permanently converted to industrial use. Although much of the proposed generation facility area would be cleared, clearing of some portions of the site, including the 70 acres of buffer, could be unnecessary, and these could be left in forest. Other buffer areas within the site could be left in forest or allowed to revert to forest. Nevertheless, the entire site would be taken out of commercial forestry production.

Depending on market conditions, the timber within the generation facility area would likely be sold prior to clearing and site grading. The current value of timber on the site is about $692 per acre, for an estimated total value of $222,824. Sale of this timber would have a negligible effect on the local timber supply market.

About 65 acres of the generation facility site is presently classified as pasture/grassland/hayland and would also be converted to industrial use. Other land that could be affected by construction includes about six acres of cropland and about two acres of water/wetlands (see Table 4.12.1.1-1). Construction of the generation facility and the ash management unit would involve the greatest amount of vegetation disturbance. This would involve primarily forested uplands, and some pasture and cropland along Besa Chitto Creek. Three small ponds within the facility boundary area could also be removed. Existing structures within the generation facility boundary include four barns, two sheds or storage buildings, four houses, and one mobile home. Construction of the generation facility would likely require removal of these structures. In anticipation of the project, the county has already decided to relocate Pensacola Road by summer 1998. The timing of the county's decision means that any impacts associated with relocating the road will occur prior to the agencies' completion of this EIS process and regardless of the decisions they make about the project.

Figure 4.12.1-1 Land use/land cover types on propsed generation facility, mine, and EcoPlex.

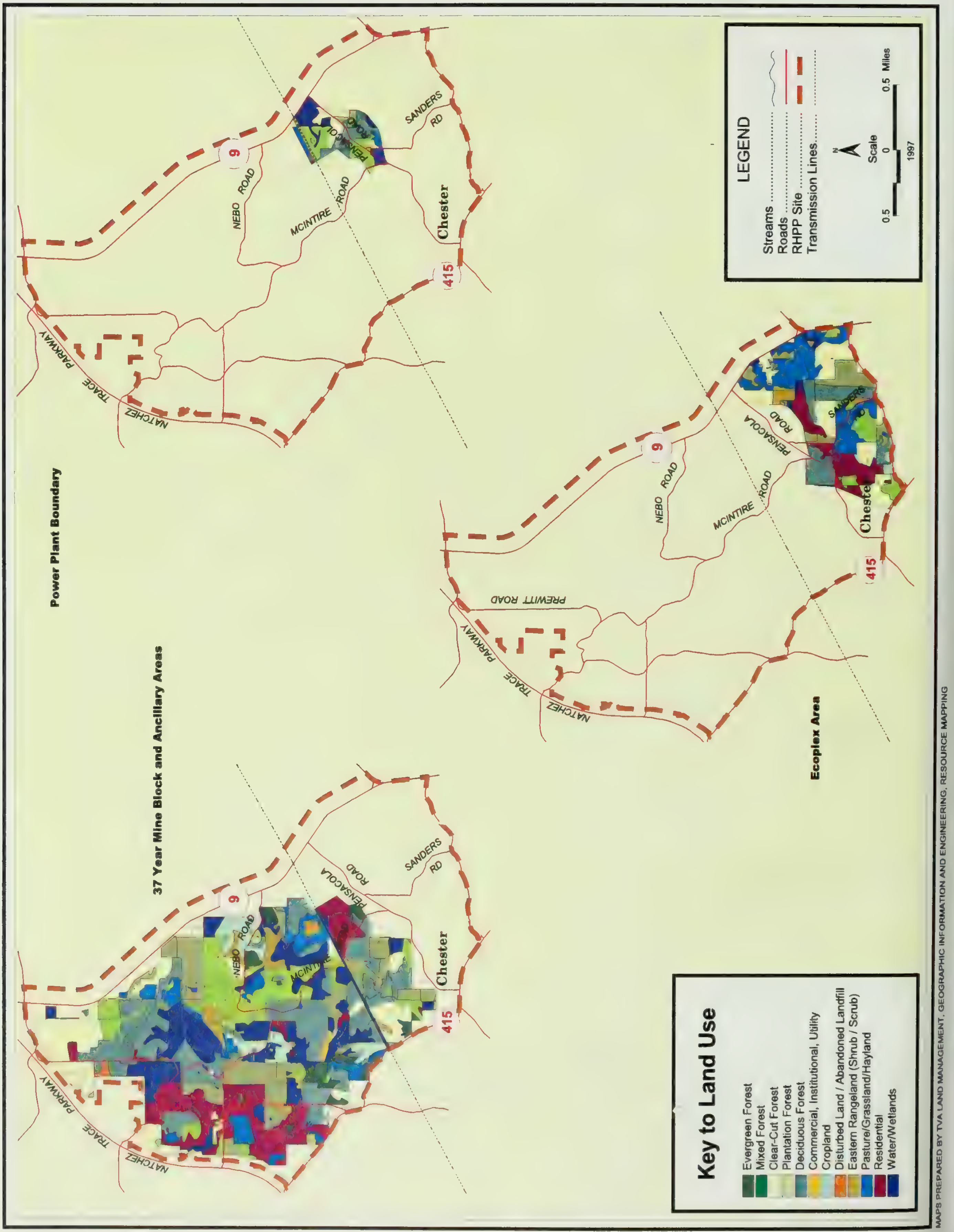


Table 4.12.1.1-1 Land Use Impacts by Activity Areas Within the Red Hills Power Project Area

Land Use/Land Cover Classification	Generation Facility		Mine and Support Facilities	
	Acres [a]	Percent	Acres [a]	Percent
Abandoned Landfill/Disturbed Land	---	---	15.5	0.3
Commercial, Institutional, Utility	---	---	36.6	0.6
Cropland	5.6	1.4	9.0	0.2
Forestry	322.1	82.6	4,925.4	85.3
(Clear-Cut Forest)	(6.2)	(1.6)	(1,170.7)	(20.3)
(Deciduous Forest)	(124.4)	(31.9)	(1,651.8)	(28.6)
(Evergreen Forest)	(62.4)	(16.0)	(183.3)	(3.2)
(Mixed Forest)	(59.0)	(15.1)	(1,261.0)	(21.8)
(Plantation Forest)	(70.1)	(18.0)	(658.6)	(11.4)
Idle Land	---	---	130.1	2.3
Pasture/Grassland/Hayland	60.3	15.5	604.9	10.5
Residential	---	---	32.9	0.6
Water/Wetlands	2.0	0.5	19.1	0.3
Totals	390.0	100.0	5,773.5	100.0

[a] Based on photointerpretation of October 1996 aerial photography and spring/summer 1997 field inspections.

Mine

Proposed mining activities would eventually affect land use on about 5,800 acres (Table 4.12.1.1-1). This includes about 3,800 acres to be disturbed over a 37-year period by the excavation and removal of lignite. These operational impacts are addressed in Section 4.12.1.2.

Construction of the mine support facilities (see Section 2.2.2 and Figure 2.2.2.3-2), including a shop and warehouse building, an office and change house building, parking areas, bucket shed, fuel storage area, vehicle ready line, wash pad, and dragline erection site would disturb about 300 acres. Change to industrial land use for the construction of these buildings and facilities could be long-term, thereby precluding their use for other purposes, unless the structures are to be reclaimed at the end of the life of the mine. Construction of spoil disposal areas would occupy about 360 acres and would require the liquidation of about 350 acres of timber valued at approximately $237,650.

Various water control structures (i.e., sedimentation ponds) as shown in Figure 2.2.1.3-3 would be constructed over the life of the proposed mine. Some of these ponds would be constructed within the area to be mined prior to mining, and they would be removed with the advancing mining and reclamation activities. Other ponds (noticeably SP-3, SP-4, SP-5, and R-1) would be constructed outside the area to be mined. These ponds would occupy a total of about 414 acres. Although all ponds would be designed for possible removal as part of the reclamation process, some may be left in place, depending on the

wishes of the owner(s) of the surface rights. Timber currently on the proposed pond sites is estimated to be worth about $261,500. Assuming ponds would be reclaimed, timber value within the former pond sites would appreciate slightly to about $267,000 (expressed in 1997 dollars) over a 40-year planning horizon.

Three occupied houses within the area of mine support facilities would be removed during construction, and their residents would relocate. Construction of ancillary mine facilities would result in a change in land use from current uses to industrial uses for at least the life of the mine (at which time the structure would be removed and reclaimed) or perhaps longer if designated as permanent facilities. This could represent a long-term loss of potential income from other uses such as forestry or agriculture if retained permanently. Liquidation of timber associated with clearing and construction on these areas is not expected to significantly affect area timber supplies or prices.

Transmission Line and Natural Gas Pipeline

Corridor A – Construction of the ROW for a 161-kV transmission line between the proposed generating facility and the Sturgis 161-kV substation would require the removal of all woody vegetation within the 100- to 175-ft wide ROW. Additionally, "danger trees" (i.e., those trees that could fall close to the transmission line) would also be felled. Approximately 162 acres of new ROW would be required, which would remove approximately 114 acres from timber production for at least the life of the transmission line. Value of this timber is estimated to be about $74,000.

Corridor B – The route of Corridor B coincides with the Corridor A route from the generating site to the Ackerman substation (see Section 2.2.3). The transmission line ROW would require approximately 170 acres, most of which is currently forested. The ROW would be 10.9 miles long and would be entirely on new ROW. About 122 acres of timber, estimated to be worth about $80,000, would be removed from production.

Natural Gas Pipeline – The proposed natural gas pipeline route would parallel the transmission line ROW within Corridor A. The ROW for the pipeline would require an additional area at the edge of the transmission line ROW, resulting in a slight loss of timber potential.

Construction of the transmission line and the natural gas pipeline would have only minor and short-term impacts on cropland and pasture, because these land uses could resume after construction activities. Since avoidance of residences and buildings is a standard practice in ROW routing, impacts to residences and buildings would likely be minimal. Open water (ponds) within the transmission line and the natural gas pipeline ROW is also typically avoided or spanned. Potential impacts on wetlands within the proposed ROW are discussed in Section 4.8, Wetlands.

4.12.1.2 Operational Impacts

Generation Facility

The most direct effects to land use from the generation facility would result from the construction of the facility and associated structures. Because of the nature of the facility operation, land use changes resulting from construction would continue at least for the life of the generation facility. The 322 acres of forest and 66 acres of pasture and cropland removed by construction of the generation facility (see Section 4.12.1.1) would create a long-term loss of fiber, food, and timber production on this land due to the dedicated use of this land for power generation purposes. Although a portion of the plant site may be occupied by forest cover, operation of the plant would likely preclude any significant commercial forest operations on these areas.

Indirectly, long-term operation of the generation facility could result in some changes in local land use. There is expected to be some economic growth, especially in the establishment of local businesses and industries that provide goods or services towards the operation of the generation facility. Development of these secondary businesses would create some additional demand for commercial/industrial land uses. There may be a slight increase in residential land use to meet housing demands of immigrating plant workers or new workers for secondary businesses.

Mine

The land use impacts resulting from mine construction activities described in Section 4.12.1.1 would continue for the life of the mine. Actual operation of the mine and the extraction of lignite would change current land uses within the 3,800 acres from which lignite would be removed. Such changes would occur incrementally over the life of the mine (i.e., 37 years) at the rate of about 127 acres per year. The predominant land use within the area to be mined is forest, with about 520 acres of recent clear-cuts. There are about 40 occupied houses along with other buildings such as barns and sheds located in the area to be mined. Eventually, these would likely be removed, as necessary, to allow for the mining of lignite.

Areas being mined would be precluded from any other land use for a time period extending from the beginning of clearing activities until the reclamation bond is released and control of the land returns to the surface landowner. This would typically be eight to nine years after the beginning of clearing activities. The postmining land use would be determined by the premining land uses, surface landowner wishes, and mining regulations. Similarly, any land that was in forestry prior to mine construction would be taken out of production until reclamation, assuming that previously forested areas are reclaimed as forestry. Some areas not currently in forestry could be reclaimed as forestry. Based on a survey of landowners within the area proposed to be mined during the first five years of mine operation, most of the area is anticipated to be returned to forestry uses. Mining regulations require that the soil productivity of reclaimed areas be at least equal to or greater than it was prior to mining. The potential for cropland and pasture/grassland/hayland land uses therefore would be restored during the reclamation process.

As stated in Section 3.12.5, forestry resources account for a significant segment of the economic income from local land use. In order to determine the economic impact of mining operations on the forestry resources, the net present value of timber resources in the mine area proper (i.e., the area to be mined) was determined over the next 40 years on both a with- and without-mine basis. In simulating forest growth and harvests associated with mine operations along with associated timber values over a 40-year planning horizon, the following assumptions were made.

- The study was restricted to the mine area; timber lands outside the mine boundary area were assumed to be unaffected by the mine.
- Only those areas currently in timber, including cut-over land, would be reclaimed as forestry after mining. Areas not in timber were assumed to be reclaimed for other, non-timber land uses.
- All land reclaimed as forestry would be planted with loblolly pine.
- Postmining soil productivity (i.e., forest site index) would be the same as the premining (original) productivity.
- Timber would be harvested from a site the year prior to excavation of the trench to extract lignite.
- Replanting of trees would occur four years after initial timber harvest (i.e., three years after mining).
- In the without-mine analysis, hardwood stands would be harvested at age 50. Hardwood stands already over age 50 would be "harvested" immediately within the simulation.
- Current timber prices according to the May/June 1997 *Mississippi Timber Price Report* (Mississippi State University Cooperative Extension Service 1997) were applied to the economic analysis. Timber prices and inflation were assumed to remain stable.

Using these assumptions, a simulation was performed to determine the economic effect of the mine operation with respect to onsite timber resources. The model accounted for annual timber harvests according to the mine plan. Growth on reclaimed land was simulated to rotation age (i.e., 35 years) for all stands in order to calculate net present value. All economic income from sale of timber was expressed in 1997 dollars.

The current value of timber in the mine area is estimated to be $2,006,992, or $646.50 per acre. Without the mine, (that is, if the mine were not in place) currently standing timber would continue to grow. Over a 40-year planning horizon, value of timber on the mine site is estimated to increase to a net present value of about $2,840,389 ($915 per acre) if the mine were not in place.

With the mine, the simulation predicted that the per acre net present value of timber would be about $960, for a total net present value of approximately $2,979,045. Thus, the implementation of the mine would result in a slight ($45 per acre) increase in the net present value of timber resources in the mine area. This increase is primarily due to the establishment of pine, a relatively high-value, short-rotation,

timber crop on reclaimed lands previously occupied by generally low value and low quality timber species.

<u>**Transmission Line and Natural Gas Pipeline**</u>

Operation of the proposed transmission line and natural gas pipeline would result in few land use impacts beyond those occurring during their construction. Therefore, operational impacts would likely be insignificant. No buildings could be constructed within the ROW. However, agricultural land use practices are allowed within a ROW, and these could continue indefinitely. Woody vegetation within the ROW would be removed periodically via mechanical and chemical means to maintain safe operation of the transmission line and natural gas pipeline. This would prevent reforestation of the ROW, resulting in a long-term but regionally insignificant reduction in forest production.

4.12.1.3 Combined Impacts of the Generation Facility and Mine

The long-term impacts of the conversion to industrial land use would be locally important. The loss of the current land uses, predominantly forestry, pasture/grassland/hayland, and cropland, would have significant local short-term impacts. These land uses, however, would eventually be restored during the reclamation process over the majority of the project area.

The RHPP would also have some indirect impacts on land use due to the resulting immigration of workers to construct and operate the generation facility and mine and the eventual economic growth of the area. This would increase the use and demand for urban and commercial/industrial land within the project area and Choctaw County.

4.12.2 No Action Alternative

Under the No Action Alternative, general land use trends within the project area would probably follow those of the surrounding county. The proportion of the area devoted to urban, residential, and transportation uses would likely continue to increase due to long-term economic growth, although at a slower rate than with the action alternative. Recent trends in forestry and agricultural land uses would also continue, although the decrease in agricultural land would probably occur at a slower rate. In the event the generation facility and mine were built and operated independent of TVA's involvement, the impacts would be expected to be similar to those described in this EIS.

4.13 Cultural and Historic Resources

4.13.1 Action Alternative (Project as Proposed)

4.13.1.1 Construction Impacts

Generation Facility

As described in Section 3.13, no historic structures listed, or eligible for inclusion, on the National Register of Historic Places (Register) occur in the vicinity of the generation facility. Construction of the generation facility would therefore not impact historically significant structures. There are no archaeological sites eligible for the Register within the construction zone of the proposed generation facility.

Mine

The construction and operation of the mine would impact archaeological sites within the mine area. The only difference between the impacts of mine construction and mine operation on archaeological sites would be in the time at which impacts occurred. The descriptions of construction and operational impacts are therefore combined in the Operational Impacts.

Transmission Line and Natural Gas Pipeline

No historic sites or archaeological sites eligible for inclusion on the Register are presently known to occur within, or adjacent to, the proposed utility corridors. All sections of utility corridors outside of the area already surveyed for the generation facility and first five-year mine area will be surveyed for historic structures and archaeological sites. The historic structures survey will include the area of potential effect (APE) for visual impacts; any adverse impacts would be mitigated in accordance with plans approved by TVA, SHPO, and ACHP. The archaeological survey would be conducted subsequent to surveying and staking the center lines of the transmission lines and pipeline. If any sites eligible for the Register are encountered, they would either be avoided or any adverse impacts would be mitigated in accordance with a research design approved by TVA, SHPO, and ACHP.

4.13.1.2 Operational Impacts

Generation Facility

No historic structures listed, or eligible for inclusion, on the Register occur in the vicinity of the generation facility. Based on the predicted air emissions (Section 4.2), the generation facility would not significantly increase ambient levels of air pollutants that could impact downwind historic structures.

Mine

The first five years of mine activities could impact seven archaeological sites potentially eligible for inclusion on the National Register. Phase II archaeological testing of these sites to determine their eligibility for inclusion on the Register began in September 1997. If any of these sites are determined to be eligible for the Register, they would either be avoided or any adverse impacts would be mitigated. Mitigation would consist of excavating portions of a site (Phase III data recovery). All data recovery efforts would be conducted in accordance with a research design approved by MLMC, TVA, SHPO, and ACHP.

A Programmatic Agreement (PA) among MLMC, TVA, SHPO, and ACHP would be executed during the spring of 1998. The PA would outline procedures to be followed to ensure compliance with Section 106 of the National Historic Preservation Act for the entire proposed mine area. As a result of this process, the impacts of mining activities on archaeological resources would be insignificant.

One known cemetery, the Tullos Cemetery, is located within the mine area. However, in accordance with the Mississippi Surface Mining and Reclamation Regulations, no mining would occur within 100 feet of this cemetery. Access would be provided to the cemetery as required. Impacts to this cemetery would therefore be insignificant.

Transmission Line and Natural Gas Pipeline

Operation and maintenance of the transmission line and natural gas pipeline would not adversely affect any eligible sites, as no new areas would be disturbed after construction is finalized.

4.13.1.3 Combined Impacts of Generation Facility and Mine

Because construction and operation of both the generation facility and mine would comply with the requirements of Section 106 of the National Historic Preservation Act, these combined impacts on archaeological resources and historic structures would be insignificant.

4.13.2 No Action Alternative

Under the No Action Alternative, the anticipated impacts to archaeological resources resulting from construction and operation of the generation facility, mine, and transmission line would not occur. However, archaeological resources within the area could continue to be impacted by other activities such as road and house construction and farming and timber management operations. If TVA does not purchase power from the generation facility, the facility and mine could still be built and operated independent of TVA's involvement and the potential impacts described would be expected to be similar to those described in this EIS.

4.14 Socioeconomics

4.14.1 Action Alternative (Project as Proposed)

4.14.1.1 Construction Impacts

Generation Facility

Employment during construction of the generation facility would average 750 workers with a peak of approximately 1,500. This peak is expected to last about three months. Project managers expect that about one-half of the workers would commute from their current residence in the local labor market area (LMA) or from areas somewhat farther away, such as Jackson and Meridian. The other half would move into the local area while working on the RHPP. Some of these movers would bring families, while others would commute weekly or as time allowed. A variety of housing would be used by these movers, including houses and apartments, where available, and motels, mobile homes, boarding rooms, or local campgrounds and RV parks.

Mine

During mine construction and development, average monthly employment would be 112 workers. Peak employment would be 150 workers; the peak would last for about five months. The location and other impacts of these workers would depend on the timing of peak employment relative to peak employment of generation facility construction. For this reason, impacts are analyzed jointly under Combined Impacts.

Transmission Line and Natural Gas Pipeline

The employment levels for these activities would be small compared to the generation facility and mine construction.

4.14.1.2 Operational Impacts

The operation and maintenance staff at the generation facility would consist of about 39 employees. At full production, the mine would employ about 120 to 138 people, with some variation due to changes in annual overburden-to-lignite ratios. Average employment during the life of the mine should be about 131, of which 39 would be staff and 92 mine workforce. The impacts of these workers are analyzed jointly under Combined Impacts. The operational impacts of the transmission line and natural gas pipeline would not be material. CGI has stated that it would work with a community advisory group to determine how best to further mitigate impacts from the generation facility.

4.14.1.3 Combined Impacts of Generation Facility and Mine

Construction Impacts

Employment – For purposes of this analysis, it is assumed that the peaks of the various construction and development activities would occur so that maximum peak employment would not exceed 1,700 workers, which is the combined peaks of generation facility construction and mine development. Many of these workers would already reside near enough to the project to commute daily, either from the LMA, as defined in Section 3.14, or further. Because of the temporary nature of construction employment, the normal commuting range for construction workers is considerably larger than that for more long-term jobs. Therefore, areas such as Jackson and Meridian would be sources of commuting for this project.

It is anticipated that about half, or 850, of the workers would commute from their current location. About one-third of these nonmovers would reside in the LMA, with the rest coming largely from the Jackson and Meridian areas, due to their relatively large work force (Table 4.14.1.3-1). The geographic distribution of nonmovers among counties in the LMA and between Jackson and Meridian is based on relative labor force sizes. The remaining half of the workers would move within commuting range of the project; it is assumed that all of these would locate within the LMA. Their location within the LMA would depend on many factors, including the availability of housing or sites for location of mobile homes. Many of the movers would prefer the convenience of easy access to the work site and would therefore locate in or near Choctaw County if housing is made available. A number of movers, however, would be attracted by the amenities around Starkville and Columbus, as well as some of the smaller places such as Kosciusko, and would prefer to locate in or near these cities. The distribution assumed for this analysis is based on these factors, on TVA experience at nuclear plant construction sites, on experience at similar projects by the firms involved in the current project, and on local visits and meetings. The largest share of the workers likely would locate in Choctaw County, due to its proximity to the project site. On the other hand, Oktibbeha and Lowndes Counties would be expected to have the next largest shares due to various factors, such as availability of housing and access to shopping and other amenities.

Table 4.14.1.3-1 Geographic Location of Construction Workers at Peak

	Nonmovers	Movers	Total
LMA			
Choctaw County	30	280	310
Attala County	35	80	115
Lowndes County	78	90	168
Montgomery County	30	50	80
Oktibbeha County	60	200	260
Webster County	20	70	90
Winston County	30	80	110
Subtotal	283	850	1,133
Outside LMA			
Jackson area	489		489
Meridian area	78		78
Subtotal	567		567
TOTAL	850	850	1,700

Total payroll during construction is likely to be around $30 million; the total income impact on the LMA would likely be in excess of $50 million. Total spending for materials and supplies during construction would be $372 million, of which at least one-third would likely be purchased within the LMA. As a result, the total income impact on the LMA would be $225 million.

Population and Housing – It is assumed that about half of the movers would bring families with them. This is less than the past experience at TVA nuclear construction projects. However, shorter construction schedules, combined with recent construction experience of Bechtel Corporation, suggest a smaller share for this project. Given this assumption, the LMA would likely see a population increase of 1,783 (Table 4.14.1.3-2), or an increase of one percent over the 1996 population of 170,520 (Table 3.14.1-2). The largest increase is projected to be in Choctaw County, where population could rise by 587 persons if housing accommodations are available; this would be an increase of about six percent. The next largest would be the increase of 419 persons projected for Oktibbeha County, about one percent of the current population of the county. Assuming an average of one school-age child per family (similar to or slightly higher than TVA experience) the schools in the area would experience a temporary increase of about 425 students. The largest increase in school-age children is likely to be in Choctaw County. However, these estimates are based on the assumption that the geographic location of movers with families would not differ from that of movers without families. Movers with families may be more attracted to places like Starkville and Columbus with more amenities than Choctaw County, while those without families may be more likely to consider proximity to the worksite and thus locate in or very near Choctaw County.

Table 4.14.1.3-2 Population Impacts of Movers at Peak Construction				
	Movers	Movers with Families	Population Increase	School-age Children
Choctaw County	280	140	587	140
Attala County	80	40	168	40
Lowndes County	90	45	189	45
Montgomery County	50	25	105	25
Oktibbeha County	200	100	419	100
Webster County	70	35	147	35
Winston County	80	40	168	40
Total	850	425	1,783	425

A variety of housing types would be needed to accommodate the anticipated movers and their families. Houses probably would be the preferred choice of most construction movers if available; however, due to the relatively short stay of construction workers, most of this demand would be for rental housing, not for purchase. Mobile homes would be the next most utilized housing choice, followed by apartments and other (sleeping rooms, RVs, etc.). The following distribution, Table 4.14.1.3-3, is based on the assumption that houses would be available in each county for 52% of workers at peak construction. The share of mobile homes, apartments, and other housing are assumed to vary between the more rural and the more urban counties. The actual distribution would depend on the type of housing accommodations that are in fact made available in desirable locations. Also, the total number of units is probably overstated somewhat since no allowance is made for workers rooming together.

Table 4.14.1.3-3 Housing Choice of Movers at Peak Construction					
	Total Movers	House	Mobile Home	Apartment	Other
Choctaw County	280	146	92	17	25
Attala County	80	42	26	5	7
Lowndes County	90	47	21	18	5
Montgomery County	50	25	17	3	5
Oktibbeha County	200	104	46	40	10
Webster County	70	36	24	4	6
Winston County	80	42	26	5	7
Total	850	442	252	92	65

<u>Local Government Revenues</u> – Revenue impacts associated with construction include: (1) sales tax proceeds associated with equipment and materials procurement, (2) sales tax revenues associated with new construction worker spending, and (3) ad valorem taxes paid by inmoving construction workers owning residential property.

An estimated $375 million worth of equipment and materials would be purchased by the project during construction. Twenty percent of this amount ($75 million) would be associated with mine development. The remaining $300 million is related to generation facility construction. An estimated 25% (or

$94 million) of the total value of equipment and materials is expected to be purchased from sources within the state of Mississippi; 10% (or $37.5 million) from sources within the seven-county LMA. Because the project would be located in Choctaw County, which is defined as a "less developed county" by the MDECD, direct purchases made by the MLMC/CGI during construction would be eligible for either a one-half or full sales use tax exemption. Under this provision, none of the sales tax revenue would be rebated to local municipalities. Therefore, purchases during project construction could add between $0 and an estimated $ 3.3 million to state sales tax revenues.

Assuming that the workforce spends 20% of what it makes on retail sales within the LMA, the annual amount of retail spending for both the mine and generation facility is estimated at $6 million during the construction period. Assuming that these purchases are subject to the current 7% retail sales tax, an estimated $420,000 per year of additional sales tax revenue would accrue to the state and local area municipal governments. Eighteen and one-half percent of the state revenues would be rebated to the local municipalities where the purchases occur.

It is anticipated that 50% of the construction workforce would move into the LMA. Only a small proportion of these workers would be expected to purchase residential property. Most construction workers would seek inexpensive rental accommodations. Therefore, additional ad valorem revenues to be generated by new construction worker residents would be minimal.

<u>Schools</u> – Comparison of the estimated number of additional school-age children (Table 4.14.1.3-2) with the available capacity by county (Table 3.14.5.1-4) shows that most of the impact counties would have the capacity to absorb projected increases. However, Webster County is already above capacity and the projected increased enrollment in Choctaw County would take all the available capacity in that county. The school situation in these two counties should be monitored to determine what actions, if any, need to be taken in order to handle the increased enrollment.

<u>Health Facility Impacts</u> – Population-based impacts on medical facilities and services from construction are expected to be minimal. During peak construction, the temporary increase in workforce population could result in an additional 65 calls for emergency medical service (EMS) per year based on standard planning factors. Due to anticipated residential distribution of workers within the LMA, existing level of services should be sufficient to meet this need. Work hour emergencies during construction could place increased demand on the Choctaw Medical Center due to its proximity to the project. The mine would place first priority on extensive safety training programs. Additionally, many employees would become EMT trained.

<u>Law Enforcement Impacts</u> – Increase in population during construction and operations would inevitably add to the level of demand for law enforcement, particularly in the communities and counties in which immigrating workers choose to reside or travel. During the peak construction phase, the temporary increase in the workforce population could result in the need for an additional three to four full-time equivalent (FTE) law enforcement officer positions. An estimated one additional officer could be needed within the LMA to serve the increased permanent population during project operations. Dependent upon

the distribution of inmoving population during the construction period, demands for increased law enforcement capability could impact selected small towns and rural areas more heavily.

While the increase in population would result in some increase in the incidence of crime, the extent of the increase would not likely be of serious magnitude. The much reported "Gillette syndrome" or "boom-town" phenomenon has occurred in situations where the increase in population was several times the existing population, not where the increases were only a small percentage of the current level. This large and rapid increase in population exceeds the capacity of the community to adjust and expand its community services, stressing community support systems and affecting quality of life in many ways (Bleiker 1980). Examples of this include Gillette, Wyoming, where population increased from 3,580 in 1960 to an estimated 14,000 by 1976; Rock Springs, Wyoming, where the increase was from 11,567 in 1970 to about 20,000 by 1976 (Larson); Craig, Colorado, which experienced an increase from 4,200 in 1970 to more than 10,000 by 1978 (Moen); and Mexia, Texas (from 2,500 to about 30,000 in 1921) and Borger, Texas, a small town which was flooded with some 45,000 oilmen and various other types in 1926 (Haley). All of these communities suffered major crime problems due to the huge influx. However, the magnitude of change that would result from RHPP is considerably smaller than any of these, possibly about 6% in Choctaw County and smaller in the rest of the LMA. Changes of this magnitude should not result in major impacts on crime.

Operational Impacts

Employment – The employment associated with operation and maintenance of the generation facility and mine would have a positive impact on population and income in Choctaw County and the LMA. Whenever practicable, the workforce would be obtained locally. While these impacts are considerably smaller than those associated with the construction and development phases, they would result in about a 5% increase in the number of jobs in Choctaw County, compared to current levels.

Total payroll from these jobs likely would be in the range of six to seven million dollars annually. The total income impact on the LMA from payroll would likely be ten to twelve million dollars. Annual spending for materials and supplies probably would be around $16 million, of which about 40% would likely be purchased in the LMA, resulting in a total income impact on the LMA of about $12 million annually from this spending.

Schools – Impacts on schools from operations would be less than peak construction.

Local Government Revenues – Revenue impacts associated with project operations include: (1) ad valorem taxes associated with the value of generation facility and mine property, (2) sales tax proceeds associated with equipment and materials procurement, (3) sales tax revenues associated with worker spending, (4) ad valorem taxes paid by inmoving workers with residential property, (5) tax revenues associated with lignite and surface lease royalties, and (6) various state taxes associated with conducting business.

The value of the generation facility and mine property would be subject to ad valorem taxes. These ad valorem tax revenues would benefit Choctaw County and the Choctaw County School District.

Definitive estimates of ad valorem tax revenues cannot be made at present. A partial 10-year ad valorem tax exemption for CGI has been negotiated and agreed upon by the state and Choctaw County. The MLMC would not be exempt and would pay the full tax during this ten-year period. In the long-term, actual revenue amounts would depend upon assessed valuation and the local ad valorem tax rate applied to the generation facility and mine. An order-of-magnitude estimate for annual generation facility and mine ad valorem taxes, during the exemption period and after the exemption period, is $2 million and $3 million respectively.

An estimated $16.1 million worth of equipment and materials would be purchased annually during generation facility and mine operations. Sixty percent of this amount, ($9.6 million) would be associated with mine operations. The remaining 40% (or $6.5 million) is for generating facility operations. An estimated 75% (or $12 million) of the total value of equipment and materials is expected to be procured from sources within the state of Mississippi annually. A high proportion of these purchases are expected to be from sources within a 150-mile radius of the project site. Therefore, at the current sales tax rate of 7%, purchases associated with generation facility and mine operations would add approximately $840,000 annually to state sales tax collections, 18.5% of which would be shared with local municipalities where the purchases occur.

Assuming that the workforce spends 20% of what it makes on retail sales within the LMA, the annual amount of retail spending for both the generation facility and mine is estimated at $1.7 million during ongoing operations. Assuming that current 7% tax rates remain unchanged, approximately $120,000 of additional sales tax revenue would accrue to the state and to local area municipalities.

It is estimated that 50 to 60 workers or 30 to 40% of the generation facility and mine operations workforce would move from outside, and take up permanent residence within, the LMA. It is anticipated that most of these workers would purchase residential property and thus add a small and undetermined amount to the ad valorem tax revenue base of the communities in which they choose to reside.

Lignite and surface lease royalties are currently projected at $1 million per year. These royalties are paid to landowners impacted by the mine site and mining operations. Ninety-five percent of the royalty owners live in the local area. Annual tax revenues associated with this source of income have not been estimated. The actual amount of revenues that would be generated depends upon various factors including financial investment and spending choices made by royalty owners.

The project developers and principal business partners involved in the RHPP (MLMC and CGI) would be subject to various state taxes associated with conducting business in Mississippi. These annual taxes would include: corporate income tax, production sales tax on coal, franchise tax, and privilege tax. Annual income tax estimates are not available. Annual state taxes, other than state income tax, are estimated to be $900,000 for the generation facility and mine combined. In addition, MLMC and CGI are subject to ad valorem (property) taxes discussed above. Business expansions indirectly related to the RHPP and occurring within the LMA would also be subject to various local and state taxes which would favorably impact the revenue base.

Water Supply Impacts – The project developers plan to purchase potable water for the generation facility and the mine from the Choctaw Water Association with a back-up supply from an onsite well that would draw from the Lower Wilcox Aquifer. An estimated 2,900 gpd would be required during operation. Since the Choctaw system has sufficient capacity to meet this need, there would be no significant impacts to area water systems.

Additional population moving into the LMA associated with the project would require a total estimated increase in water consumption of approximately 180,000 gpd during peak construction and 30,000 gpd during operations. This would place increased demands on local water systems within the LMA. If the estimated inmoving employee and family population is distributed as shown in Table 4.14.1.3-2, available capacity of the municipal water systems should be sufficient to meet this need. There may be localized exceptions where incoming populations would impact small water systems. No attempt has been made to estimate these localized water system impacts. In most cases, such impacts are expected to be minimal. The greatest impact likely would occur in Choctaw County and would depend both on the size and residential distribution of the inmoving population within the County.

Assessment of local water supply system impacts was limited to those generated by additional population moving into the area. The water requirements and the potential impacts of water used for project construction and operation are considered in Section 4.6.

Sewer Impacts – Project sanitary wastewater requirements and impacts are discussed in Section 4.6. RHGF would have its own onsite septic tank and the RHLM would have its own onsite sanitary wastewater treatment system. Therefore, area municipal wastewater facilities would not be impacted directly by generation facility or mine operations.

Additional population moving into the LMA associated with the project would add a total estimated daily wastewater treatment demand of 120,000 gallons. This would place increased demands on local wastewater systems serving communities in which inmoving employees and families choose to reside. If the estimated inmoving employee and family population is distributed as presented in Table 4.14.1.3-2, available capacity of the municipal wastewater systems should be sufficient to meet this need. There may be localized exceptions where incoming populations would impact small systems. In most cases, such impacts would likely be minimal. The greatest impact would likely occur in Choctaw County and depend both on the size and residential distribution of the inmoving population within the County. New temporary or permanent residential developments in rural areas would have to construct and rely on acceptable onsite sanitary wastewater treatment methods that comply with local and state health requirements. Total estimated daily wastewater treatment demand associated with additional permanent population during project operations is 20,000 gallons.

Health Facility Impacts – Population-based impacts on medical facilities and services from operations are expected to be minimal. In the long-term, an additional 11 EMS calls per year could be expected due to the additional operations employees and their families living in the LMA. Assuming that these employees and their families are distributed within the LMA, as discussed in Section 4.14.1.1, the existing LOS within Choctaw County and the surrounding area should be sufficient to meet this need.

Law Enforcement Impacts – Law Enforcement impacts from operations would be insignificant, as discussed under Construction Impacts.

Fire Protection Impacts – Fire protection measures would be incorporated into the generation facility design and the mine operations plan. These measures would include fire detection equipment, fire extinguishing systems, a continuous fire main loop and onsite storage of water dedicated to fire protection, and an extensive fire training program. Design, equipment, and materials would be in accordance with the requirements of National Fire Protection Association, Underwriters' Laboratories, and applicable local requirements.

An emergency preparedness plan would be developed by the project developers and include elements involving proper coordination with appropriate emergency response organizations within the surrounding community. Such a plan would require that area response organizations meet acceptable standards. The preparedness level of nearby volunteer fire departments especially, would have to be addressed. Response capability of these departments is limited due to lack of equipment, training, effective communications, travel distances, and location of personnel during normal work hours. Support of surrounding local firefighting organizations would be necessary in the event of a catastrophic failure, such as a major fire in the lignite handling and storage system.

The only direct impact the project itself might have on the existing fire protection capabilities of nearby departments involves the availability of water. Since the project onsite systems would be relying on water drawn from the Tuscaloosa Aquifer System and Lower Wilcox Aquifer, the onsite fire protection plans would not affect the capacity of other existing services in the area. Available water supply would be permitted for fire protection.

Impacts of increased population on fire protection services are expected to be minimal with the possible exception of particular areas within Choctaw County that could be impacted by new incoming residents. Temporary increase due to the construction workforce could result in a need for an additional three FTE firefighter positions during the peak construction period within the LMA. Less than one additional FTE firefighter position would be required to serve the total estimated increase in permanent population associated with project operations.

Land Value Impacts – Land values would most likely increase as a direct and indirect result of the investments and new economic activity the RHPP would bring to the LMA and to Choctaw County. Project impacts on land values would be determined by a variety of factors. Timing of mining over the 37-year period in relation to individual parcels, lignite and surface lease agreements, temporary loss of timber/agriculture productivity, reclamation effectiveness and postmining uses, and the nature and extent of developments occurring adjacent to the project area all would have an impact in determining future land values in the project area.

Land values within the LMA may be affected by the residential preferences of inmoving members of the workforce and their families and business decisions made as an indirect result of the project's presence and operation. In the long-term, land values would be affected by the ability of area and community

leaders to cooperate and take advantage of the opportunity to guide area development in desired ways and to take the preparatory steps necessary so that future decisions result in the wise investment and allocation of increased public resources.

4.14.2 No Action Alternative

Without the proposed project, the local governments and communities within the LMA would not be impacted by the increased demands on community services due to increased population nor would they benefit in the long-term from the increased revenues that would otherwise be generated. However, in the event the generation facility and mine were built and operated independent of TVA's involvement, impacts to the socioeconomic would be expected to be similar to those described in this EIS.

4.15 Environmental Justice

The environmental justice analysis focused on addressing two basic questions. Does the potentially affected community include minority, low-income, and/or aged populations? Are the environmental impacts likely to fall disproportionately on minority, low-income, and/or aged members of the affected community? The method of determination involved three distinct steps: (1) a situation review, (2) a screening analysis, and (3) information-gathering discussions.

A situation review was conducted during the earliest stages of the EIS process that was specifically designed to identify areas of community need and anticipate community impact issues. This phase included interviews with key informants knowledgeable about the community and region; review of pertinent community studies, surveys, and literature; contact with area planning representatives and review of community planning activities; and public participation in the EIS scoping process. It was discovered during this phase, that a recent survey of local area residents had been conducted by an MSU graduate student under the auspices of The Social Science Research Center affiliated with the University. Demographic information resulting from this community survey provided a timely benchmark for the environmental justice evaluation.

4.15.1 Action Alternative (Project as Proposed)

4.15.1.1 Construction Impacts

Impacts of the generation facility, mine, and transmission line and natural gas pipeline are discussed in Section 4.15.1.3, Combined Impacts.

4.15.1.2 Operational Impacts

Impacts of the generation facility, mine and transmission line and natural gas pipeline are discussed in Section 4.15.1.3, Combined Impacts.

4.15.1.3 Combined Impacts

A screening analysis of 1990 Census data shows minority, low-income, and aged population to be present in District 1 (Figure 3.15-1). Of the total District 1 population of 1,321 residents, 331 (25%) were black, 15 (1%) were American Indian, and 6 were Asian. Two hundred and ninety-five persons (22%) were below the poverty line in 1989 and 134 residents (10%) were 65 or more years of age.

Data showing the presence of minority, low-income, and aged population provide little information about their residential distribution within the area, proximity to the project site, and propensity for being impacted disproportionately. Further analysis of Census data was conducted to determine whether or not the minority, low-income, and/or aged population sectors within the affected community (i.e., Census District 1, see Figure 3.15-1) were meaningfully greater when compared to the general population. Table 4.15.1.3-1 provides comparative data showing each of the three population sub-groups as a proportion of the total population for Census District 1, Choctaw County, the seven-county labor market area, and the state of Mississippi.

Table 4.15.1.3-1 Environmental Justice Population Group Comparisons, 1990

	Black Population (%)	Persons Below Poverty (%)	Persons Age 65 and Over (%)
District 1	25.1	22.3	10.1
Choctaw County	30.1	25.0	14.7
Labor Market Area	36.5	26.5	12.6
State	35.6	25.2	12.5

This table shows that the percentages of the District 1 population groups analyzed are less, in all cases, than the equivalent proportion of the total population made up of the same groups in the broader units of comparison. For instance, the proportions of the total population living below poverty in Choctaw County, the seven-county labor market area, and the state of Mississippi are higher than in District 1, the affected community.

Following the Census data screening analysis, information-gathering discussions were conducted using a statistical profile of the affected community as a reference. Particular attention was given to identifying the presence of any high concentration "pockets" of minority, low-income, or aged populations within specific locations of the immediate project area that could not be detected due to the way Census data are disaggregated. The discussions included the following: consulting with community leaders and members of nearby communities; consulting with officials in state and/or local government agencies and other members of the EIS team; outreach to community-based organizations and soliciting information from the affected community. In all of these discussions, no new information was identified, no

concentrations of population groups that might be disproportionately affected were identified, and the results of the Census data analysis were confirmed.

Information gathered and analyzed for the purpose of addressing environmental justice concerns associated with the project indicates that, while some members of the affected community are minority, low-income, and aged and may be impacted by the proposed action, none of these populations would be impacted in a way that can be considered unfair or disproportionate in relation to the larger community of which they are a part.

4.15.2 No Action Alternative

Without the proposed project there would be no environmental justice impacts to be considered. However, if TVA were not to purchase the electricity, the generation facility and mine could develop independent of TVA's involvement and the impacts would be similar.

4.16 Transportation Facilities

4.16.1 Action Alternative (Project as Proposed)

The RHPP has the potential to impact rail, air, pipeline, and highway transportation. There would be little if any impacts on the rail system for the project as presented. No new rail spur to the site is planned, so the facility would not be able to directly connect to the railway and receive regular shipments. Similarly, air transportation would not be notably impacted. Air passengers would comprise a small percentage of travel resulting from the proposed project, and as noted in Section 3.16, a large variety of airports are available within two hours driving distance of the site, which could provide alternate air travel routes. A natural gas pipeline to serve the RHPP would be constructed by the Town of Weir and would connect to the Texas Eastern Pipeline, east of State Highway 9. The construction, maintenance, and operation of the pipeline would be overseen by the Mississippi Public Service Commission Division of Pipeline Safety. The effect of the proposed RHPP on highways would be the most notable transportation impact, so an LOS analysis was performed on the roadways surrounding the RHPP to quantify the potential effects. A description of this analysis is presented in Section 3.16.

4.16.1.1 Construction Impacts

Impacts from construction of the generation facility and mine are discussed in Section 4.16.1.3, Combined Impacts. The construction of the pipeline would be overseen by the Mississippi Public Service Commission Division of Pipeline Safety. The impact of construction of these utility lines on transportation services would be insignificant.

4.16.1.2 Operational Impacts

Impacts from operation of the generation facility and mine are discussed in Section 4.16.1.3, Combined Impacts. The maintenance and operation of the pipeline would be overseen by the Mississippi Public Service Commission Division of Pipeline Safety. TVA would be responsible for operation and maintenance of the proposed transmission line. The impact of operation and maintenance activities are expected to be insignificant.

4.16.1.3 Combined Impacts of Generation Facility and Mine

<u>Construction Impacts</u>

The effects that the proposed RHPP could have on surrounding roadways during construction was considered during the peak period for both the generation facility and the mine. It was assumed that the peak in construction occurred simultaneously for the two facilities. These activities would result in approximately 1,700 workers onsite during this time. An average value of one and one-half riders per vehicle was assumed in order to calculate the number of trips that would be generated by this workforce. The socioeconomic data in Section 4.14 was used to derive a directional distribution that represented the typical routes and roads that workers would use to travel to and from the site. It was also assumed that the generation facility and mine construction would generate 154 and 36 delivery truck trips per day, respectively. These daily traffic numbers were used to calculate the projected traffic volume for the 30th busiest hour of the year. The projected traffic figures were superimposed on the existing volumes used in the baseline calculations of Section 3.16 to obtain total projected volumes. These total volumes were then used in the LOS procedure to qualify the effects of the proposed project on roadways.

Values for LOS for the peak construction period can be seen in Table 4.16.1.3-1. The LOS, of each road involved, decreased at least one level. The most dramatic impact appeared on Pensacola Road, which fell from an existing LOS of A to a predicted one of E. This means that Pensacola Road would be near capacity at construction peak, but its capacity would not be exceeded. Marked decreases in LOS were also predicted on Highway 415 and Highway 9. These roads are nearest the site, and would handle the largest amounts of RHPP traffic before it dispersed to the surrounding roadways. Both of these roads would drop to a LOS of D, along with Highway 12 and Highway 82.

Table 4.16.1.3-1 Levels of Service Due to Construction at Peak			
Road Name	Construction Peak Hr Vol. (vehicles)	Existing LOS	Construction LOS
Pensacola Road	1179	A	E
Highway 415	600	A	D
Highway 9	859	B	D
Y Road	250	A	B
Highway 15	442	A	C
Natchez Trace Parkway	273	A	B
Highway 12	983	C	D
Highway 82	780	C	D

The peak construction impacts would only be felt for a period of approximately three to five months. Most LOS would then rebound to a higher level. Additional traffic controls, as appropriate, would help lessen peak construction traffic impacts.

The LOS listed in Table 4.16.1.3-1 could be improved by providing bus service from surrounding towns to the site. This would decrease the number of vehicles traveling on the roads during the morning and evening rush hours. A private company currently buses workers between Louisville and a nearby chicken processing plant, and could expand their service to include the RHPP (K & J Tours, personal conversation 12/17/97). Similar arrangements could possibly be made with companies in the other surrounding communities. To reduce project-related traffic on the Natchez Trace Parkway, CGI and MLMC would not allow delivery trucks to use the Parkway and would discourage their employees from commuting on the Parkway.

Some of the larger pieces of the generation facility equipment would arrive by rail and then be transported over road to the site. All oversize and overweight loads shipped by rail would arrive at an available site in Ackerman. The load would be transferred to truck, trailer, or special over-the-road vehicle for transport north on Route 9 to the site (Dave Seitzinger, personal communication 12/10/97). These loads would only cause short-term disruption of the traffic flow. Effects on the LOS could be minimized by staging the deliveries to occur during non-peak traffic hours.

Operational Impacts

Potential traffic effects due to the operation of the RHPP were calculated assuming that there would be 39 employees of the generation facility and 131 employees of the mine. Again, all employees were assumed to arrive at the site during the same hour. These calculations also account for material deliveries to the site including 175 limestone trucks per week, and 350 miscellaneous delivery vehicles per month to the generation facility and 378 delivery vehicles per month to the mine. All of these trip generators were converted into trips during the 30th busiest hour of the year (Section 3.16) and were superimposed on the existing peak hour traffic. LOSs were then determined for the identified roads surrounding the project.

The results of the LOS analysis for operational impacts can be found in Table 4.16.1.3-2. Traffic during the operational phase of the RHPP would have little effect on the existing conditions as perceived by motorists. Three of the identified roads dropped from LOS A to LOS B, while the remainder stayed at the same LOS. This change would not greatly impact motorist perception since expectations of travel at 55 mph or higher are characterized by LOS B (Transportation Research Board 1994).

Table 4.16.1.3-2 Levels of Service Due to Operations

Road Name	Operation Peak Hr Vol. (vehicles)	Existing LOS	Operation LOS
Pensacola Road	156	A	B
Highway 415	136	A	B
Highway 9	337	B	B
Y Road	86	A	A
Highway 15	292	A	B
Natchez Trace Parkway	204	A	A
Highway 12	586	C	C
Highway 82	742	C	C

The generation facility would have annual maintenance outages during either the spring or fall. This would result in extra temporary employees to perform the outage work. The number of employees required would average 200 for a period of two weeks biannually, and should never exceed the number that has been analyzed for the peak construction force traffic in the preceding section. Therefore, the LOS on surrounding roadways during maintenance outages should never be lower than those seen in Table 4.16.1.3-1. These periods of maintenance work would be short-term and any potential impacts would be transitory.

To reduce project-related traffic on the Natchez Trace Parkway, CGI and MLMC would not allow delivery trucks to use the Parkway and would discourage their employees from commuting on the Parkway.

Several of the inter-project county roads mentioned in Section 3.16 would be altered during the operation of the mine. These roads are listed in Table 3.16.3-1. The MLMC would present any road closure or alteration plans to the Choctaw County Board of Supervisors for approval before taking any action. These closings and/or relocations could last up to five or more years while lignite is excavated in the vicinity of each road in question. In all road closure and rerouting proposals presented by the MLMC, surface owner access would be provided to lands not being mined. Surface owner access would be controlled, but not prohibited, on lands actively being mined for safety concerns (MLMC 1997).

The only proposed closing for the first five years of the mine would be McIntire Road from its intersection with Pensacola Road northward to the Nebo/Null Road intersection. Access would be available to the northern end of this area from either Nebo Road or Null Road. Future road closings and/or reroutings would be planned later and presented to the Choctaw County Board of Supervisors for approval before taking any action.

After mining and reclamation has taken place, public roads would be reconstructed in their original location or a more suitable location as approved by the county. All roads would be built to at least the standards of

the existing roads. The Board of Supervisors would be addressed to review the new roads and approve them before reopening them to the public. The roads would then be released to the county for maintenance (MLMC 1997).

4.16.2 No Action Alternative

Under the No Action Alternative, if the generation facility and mine were not built, there would be no sudden addition of workers, and therefore no impacts from construction. According to the latest census figures, Choctaw County grew in population by 2.4% from 1990 to 1996. This growth would tend to affect the traffic on local roadways. Assuming the same growth rate for the next four years and assuming that traffic would grow by the same amount, an LOS analysis was applied to yield the impacts of the No Action Alternative on local traffic. The results can be found in Table 4.16.2-1.

Table 4.16.2-1 Levels of Service Due to No Action Alternative

Road Name	Peak Hr Vol. (vehicles)	Existing LOS	Future (yr 2000) LOS
Pensacola Road	34	A	A
Highway 415	116	A	B
Highway 9	247	B	B
Y Road	23	A	A
Highway 15	247	A	A
Natchez Trace Parkway	186	A	A
Highway 12	552	C	C
Highway 82	701	C	C

All LOSs remained the same for this alternative except for Highway 415, which dropped from LOS A to LOS B. These results indicate that motorists would continue to perceive a high quality of service from the roadways. If the generation facility and mine project is completed independent of TVA involvement, activities and impacts to transportation would be expected to be similar to those described in this EIS.

In anticipation of the project proceeding, the county has decided to relocate Pensacola Road. The county plans to do this the summer of 1998. This road work would be completed whether or not the project proceeds.

4.17 Public Health

There are several public health and safety issues that potentially could impact the surrounding environment of the RHPP. They could include the emergency medical response to aid an injured worker on the project site, the release of a toxic gas or vapor that drifts offsite to neighboring residences, the emissions of air pollutants, the effects of electric and magnetic fields, and the effects of radiological impacts. Section 3.14.5.4 describes the current emergency services capabilities within response distance from the project, Section 3.17.1 describes the EPA regulations covering the catastrophic release of toxic and flammable substances, Section 3.2.2 describes the NAAQS, and Section 3.17.3 describes the radiological impacts.

4.17.1 Action Alternative (Project as Proposed)

4.17.1.1 Construction Impacts

Generation Facility

Worker Injury and Illness – The 1995 reporting-year information on industrial injuries is the most recent data available from the Department of Labor - Bureau of Labor Statistics (BLS). The national recordable injury rate for heavy construction in 1995 was 9.7 injuries per 100 workers per year (9.7/100/yr). During construction of the generation facility there would be about 750 workers onsite and a three-month peak of about 1500. Applying the injury rate of 9.7 for heavy construction to the 750 person workforce at the generation facility gives an expected recordable injury total of 73 per year (Table 4.17.1.1-1). This would be about 1.4 injuries per week that probably would need offsite medical care and might need ambulance transportation. The impact of one to two additional injuries per week would not significantly impact the available medical and ambulance services. At peak construction levels the potential impact would be 3 to 4 per week. This level could have a moderate impact on emergency services.

Table 4.17.1.1-1 summarizes the estimated worker injury impact for each phase of the project.

Table 4.17.1.1-1 Estimated Worker Injury Impact on Emergency Medical and Ambulance Services

			Expected Recordable Injuries and Illnesses		
Project Phase	BLS Rate (#/100/yr)[1]	Estimated Worker Pop.	Yearly	Monthly	Weekly
Construction					
Generation Facility	9.7	750 [2]	73	6	1 to 2
Mine	10.6	110 [2]	12	1	<1
Total		865	85	7	2
Peak Construction					
Generation Facility	9.7	1500 [2]	146	12	3 to 4
Mine	10.6	150 [2]	16	1 to 2	<1
Total		1650	162	13 to 14	4 to 5
Operations					
Generation Facility	5.7	39 [2]	2 to 3	<1	<1
Lignite Mine	9	131[2]	14	1 to 2	<1
Total		170	16 to 17	1 to 2	1

1. 1995 BLS total recordable injury rate.

2. Taken from preliminary design documentation.

A tragic, multi-person construction accident could challenge the current emergency medical care and ambulance services. This impact would be similar to a multi-vehicle accident involving several vehicle occupants. This type of accident would be a significant, temporary impact that would require responses by several service providers. These are rare occurrences that require coordinated planning, but usually they do not warrant any increased staffing or other expenditures.

Mine

Worker Injury and Illness – Mine construction would average about 110 workers and peak at about 150. Applying the BLS 1995 statistic, the rate of 10.6/100/yr to the average employment gives an expected recordable injury total of twelve per year, or about one per month (Table 4.17.1.1-1). This injury rate would have no impact on available services. The peak level would be only slightly higher at sixteen per year or one to two per month.

Transmission Line and Natural Gas Pipeline

Worker Injury and Illness – Construction of the transmission line and natural gas pipeline would employ relatively few construction workers compared to the generation facility or the mine. The impact on medical and ambulance services from on-the-job injuries would be negligible.

4.17.1.2 Operational Impacts

Generation Facility

Worker Injury and Illness – The operating generation facility would have maintenance and process hazards for their workers. These hazards would be different than those experienced during construction. Operational employment at the generation facility is expected to be about 39 (Burns & McDonnell 1997). The BLS 1995 injury rate for electrical generation service is 5.7/100/yr. Applying this rate to the operational employment level gives an expected injury total of about two per year at the generation facility. These two injuries should have no impact on current medical and ambulance services.

Catastrophic Release of Hazardous Materials – The hazard assessment requirements of 40 CFR 68, Subpart B, mandate that applicable owners and operators analyze the catastrophic release of their hazardous materials for offsite consequences. This analysis must include the worst case release and one alternative release scenario. Both toxic and flammable hazardous materials used in operational processes and that meet the threshold quantities are regulated. EPA provides guidance in conducting these analyses (RMP Offsite Consequence Analysis Guidance, 1996) and establishes acceptable end points for toxic and flammable releases. Other recognized risk assessment or modeling algorithms can be used in the analysis if their use is completely documented.

Design information indicate that the generation facility has hazardous materials above the threshold quantities that require hazard assessment. The hazardous materials at the generation facility are gaseous chlorine in the circulating water treatment systems and natural gas used during startup of the main lignite-fired boiler units and used to heat the auxiliary boilers when the main units are shut down or operating at low loads.

Three, one-ton containers of gaseous chlorine would be at the generation facility during normal operations. One container would be connected to the water treatment system, and the other two would be backups. The worst case release scenario is the venting of a full chlorine container (about 1,600 pounds) while it is being connected to the system. Using the most conservative modeling parameters as required by EPA in its guidance document, the area of impact could extend as far as 5.7 miles (9,200 meters) downwind of the plant until EPA's acceptable toxic end point of 8.7 mg/m^3 (3 ppm) is reached.

The 5.7-mile radius defines a circle of about 102 $miles^2$ with the generation facility in the middle. Using the Choctaw County average population density of 21.6 people per $mile^2$ there would be about 2,205 people who might be impacted if this worst case chlorine release occurred.

However, EPA acknowledges (RMP Offsite Consequence Analysis Guidance 1996) that the entire population of the circle would not be impacted if there were a release, because the chlorine plume would move with the prevailing wind. EPA does not provide guidance on analyzing the size of this reduced impact area. The Chlorine Institute does provide some guidance. In its Pamphlet 74 (Estimating Areas Affected by a Chlorine Release, 2nd Ed. 1991), the institute presents several release scenario analyses based on the SAFER/TRACE® model developed by SAFER Emergency Systems. In the similar worst case release scenario for a one-ton container and using stable atmospheric conditions, the model defines a plume that covered about 4.8% of the total potential impact circle. Applying this percentage to the worst case release from the generation facility gives an average potentially impacted population of about 106 people.

Based on wind direction at the time of the worst case release scenario of the chlorine, some specific public and environmental receptors could be impacted. Within the 5.7-mile radius are the Town of Ackerman and two schools; the communities of Chester, Reform, and Williams; and about nine miles of the Natchez Trace Parkway including the Jeff Busby developed area. Also inside of this area would be the Red Hills Lignite Mine. The number of potentially impacted people could vary widely if the prevailing wind would carry the chlorine plume towards or away from these population centers. The Cumulative Impacts section discusses some mitigating factors that lessen the potential for this possible impact.

The alternative release scenario of the chlorine is a leak in the piping system that vents two pounds per minute for an hour until the leak is repaired. EPA allows owners and operators to use less conservative modeling parameters, yet still realistic ones, for the alternative analysis. This scenario would impact a circular area about 0.15 miles (242 meters) from the leak point. The acceptable toxic end point would be reached while still on the generation facility.

The worst case release scenario for natural gas at the generation facility would be an explosion from a rupture in the main line which has a design flow rate of 19,000 standard cubic feet per minute (scfm). By using EPA's ten-minute release period this would produce an explosive plume of 190,000 cubic feet, or about 9,000 pounds of natural gas at ambient conditions. The acceptable end point of less than one pound per square inch overpressurization would be met at a little less than 0.18 miles (290 meters) which

is still on the generation facility site. The acceptable radiant heat end point of five kilowatts per square meter for 40 seconds would be at about 0.15 miles (242 meters) which also is still on the generation facility site. Since the worst case release scenario end points do not go offsite, it is not necessary to analyze an alternative scenario.

Air Pollutants – Once the facility is operational the potential impacts would be similar to that described in the Combined Impacts section.

Radionuclides – The computer code CAP88-PC was used to calculate the radiological impacts of the atmospheric emissions from the operating generation facility. CAP88 is approved by the US EPA (1992) for this use. Conceptually, the computer code consists of two parts. The first part is standard atmospheric dispersion modeling similar in principal to the modeling of the atmospheric impacts discussed elsewhere in this EIS. This portion of the code estimated the amount of airborne naturally-radioactive particulates emitted from the facility that are inhaled by people or are deposited on vegetation or the ground at distances up to 50 km in the 16 directions of the compass. Given the estimated activity that is inhaled or deposited on vegetation or on the ground, the second portion of the model then estimates the dose equivalent that an individual would receive from that material based on ingestion of various foods.

In order to run this code, it was necessary to estimate the quantity of naturally-occurring radioactive materials that are emitted annually to the atmosphere by the facility. The sample was radiologically analyzed using a low background, intrinsic germanium gamma spectrum analysis system for a four-hour analysis count time. This analysis identified nine naturally-occurring radionuclides in the sample (Table 4.17.1.2-1).

Table 4.17.1.2-1 Radiological Content of Lignite/Limestone Ash Sample

Radionuclide	Concentration (pCi/g)
Tl-208	0.791
Bi-212	2.61
Pb-212	2.31
Ra-224	2.58
Ac-228	2.25
Bi-214	2.87
Pb-214	3.29
Ra-226	2.87
K-40	7.01

The first five radionuclides in the above list are members of the thorium chain. With the exception of Tl-208, which has a branching fraction of 36% (Kocher 1981), the average activity of the radionuclides in this chain is 2.4 pCi/g. The other members of the thorium chain are certainly present in the sample, but do not emit gamma radiations that would allow their detection by the system used.

The next three radionuclides in the above list are members of the uranium chain. The average activity of the radionuclides in this chain is 3.0 pCi/g. The other members of the uranium chain are also certainly present in the sample, but also do not emit gamma radiations that would allow their detection by the system used.

The last radionuclide on the list is K-40, a primordial, non-chain radionuclide with a concentration of 7.0 pCi/g. No other radionuclides were identified in the sample.

Three hundred and forty tons per year of particulate matter would be emitted from the generation facility. This would result in the annual emission of 0.92 mCi of each radionuclide in the uranium chain, 0.74 mCi of each radionuclide in the thorium chain, and of 2.2 mCi of K-40. Because of TL-208's branching fraction of 36%, the emission rate of TL-208 was found to be 0.27 mCi/yr.

Generation facility operational parameters and meteorological data that were used to model atmospheric impacts were also used in the CAP88 code. Those parameters are described in Section 3.2.

Using these input data, CAP88 calculated the committed effective dose equivalent to the maximally exposed individual to be 0.2 mrem/yr at a distance of 500 meters southeast of the facility. This is approximately a 0.07% increase above the natural background dose rate of 290 mrem/yr that is typical for that area. The 0.2 mrem/yr maximum dose is for lower than the range of many other naturally-occurring, medical, and lifestyle sources.

Mine

Worker Injury and Illness – The potential operational public health and safety impacts for the lignite mine are the same as discussed in Construction. Operations at the mine would continue to use and maintain heavy equipment as did the construction phase. Worker injuries would be caused by the same types of accidents.

Employment levels at the lignite mine are expected to be about 131 total at full production. This is broken down into 92 in mining and 39 in management, engineering, and support. BLS's 1995 injury rate for the bituminous and lignite mining industry is 9.0/100/yr. Multiplying this rate times the total employment of the mine gives an expected injury total of about 11 per year that would probably require offsite medical care and possible ambulance transportation. This should cause a negligible impact on the existing services.

Catastrophic Release of Hazardous Materials – Design information for the mine indicate that hazardous materials which could be involved in a catastrophic release are below the threshold quantities that require hazard assessment. There are no known air pollutants, electric and magnetic fields, or significant amounts of radionuclides identified with mining operations. Therefore, no significant impacts are expected.

Transmission Line and Natural Gas Pipeline

Electric and Magnetic Fields – The production, transmission, and use of alternating current electricity create both electric and magnetic fields (EMF). The strength of an electric field is related to the voltage level, while the strength of a magnetic field is related to the amperage level. Both fields decrease in strength with distance from the source.

Public concern about whether any adverse health effects are caused by EMF has existed since at least 1979. Over the last 18 years there have been over 20,000 documented studies of the effects of EMF. Some of these studies have suggested a weak statistical relationship between EMF and some forms of cancer. Most studies, however, have shown no such relationships, and laboratory research has been unable to find a cause and effect relationship between health impacts and both normal and extremely high levels of EMF. These studies were recently reviewed by an expert panel of the National Research Council (NRC 1996), which concluded that exposure to EMF does not present a hazard to human health. The NRC study did note a weak positive association between childhood leukemia and substitute indicators of potential residential exposure to magnetic fields. A more recent National Cancer Institute expert panel study of this topic (Linet et al. 1997) concluded there was no association between the incidence of childhood leukemia and residential magnetic field levels.

The primary new source of public or employee exposure to EMF resulting from the RHPP would be from operation of the proposed transmission and service lines. TVA tries to minimize public exposure to transmission line EMF, in part because of the public's perception regarding EMF. TVA's standard practice, which has been followed in planning for the RHPP, is to maintain to the extent practicable a distance of at least 300 ft between the transmission line and occupied buildings, except schools, for which the distance is 600 ft. Because EMF from transmission lines has very low energy it diminishes quickly with distance, thus there would be minimal increases in EMF exposure. The projected EMF strength at the edge of the proposed ROW would be well within the guidelines established by state regulatory agencies in Florida and New York, the only states with such guidelines for magnetic fields, and slightly less than other states' guidelines for electric fields. No impacts to public health through increased exposure to EMF from the transmission powerline is anticipated.

Refer to the transmission line and natural gas pipeline discussion in Section 4.17.1.3 for other public health concerns.

4.17.1.3 Combined Impacts of the Generation Facility and Mine

Worker Injury and Illness – At the normal construction workforce levels the combined expected injuries and illnesses is two per week, see Table 4.17.1.1-1. This would be an insignificant impact on emergency services. At peak construction, about four to five injuries and illnesses per week would be expected which would be a moderate impact. This impact could be mitigated by coordination between the RHPP construction and the surrounding service providers.

The total operational employee population of 170 for the RHPP is shown in Table 4.17.1.1-1. Applying the respective industry injury and illness rates gives an expected number of about one per week. This would be an insignificant impact.

Catastrophic Release of Hazardous Materials – During the construction of the generation facility, mine, and transmission line and natural gas pipeline, there would not be toxic or flammable regulated substances that meet the EPA threshold quantity at any of these sites. The small quantities of the few hazardous materials that would be onsite during construction do not have the potential for offsite impacts. Once the natural gas pipeline is in place the potential impact would be similar to that described in the Operational Impacts, Section 4.17.1.2.

Since there are no reportable quantities of hazardous materials at the mine during operation, the combined impact would be the same as for the generation facility by itself during operations, see Section 4.17.1.2.

Air Pollutants – Construction of the RHPP as proposed would cause the emission of air pollutants. The MDEQ and the EPA have regulations that restrict the emission of air pollutants to protect the public health and assure that the NAAQS are attained and maintained. The results of the atmospheric modeling of emissions from the RHPP, shown in Table 4.22.2-1 and Table 4.2.1.2-10, show that the NAAQS should be met and that levels of hazardous air pollutants would be very low and substantially below guideline levels. These results demonstrate that the public health would be protected from exposure to air pollutants generated from the proposed project.

4.17.2 No Action Alternative

No changes from existing radiological conditions would result from the No Action Alternative. The potential impacts of TVA not contracting to purchase the electrical power from RHPP range from none to about the same as describe in these sections. If TVA does not purchase the power it could be sold to another electrical transmitter or distributor for retail sales and the impacts would remain about the same. There are several intermediate scenarios that could occur. For example, these might include a smaller generation facility and lignite mining for offsite sales.

4.18 Hazardous and Solid Waste

4.18.1 Action Alternative (Project as Proposed)

Hazardous waste, used oil, and nonhazardous solid waste (solid waste) are expected to be produced during the construction and the operational phases of the project for the generation facility, the ash management unit, the mine, and the transmission line and natural gas pipeline. Among these materials, only some of the solid waste would be disposed of onsite or stored onsite for extended periods. Only onsite solid waste management has the potential to have a direct environmental impact on this project. Leaching of constituents from the ash management unit has the potential for impacting the groundwater below.

4.18.1.1 Construction Impacts

Limited quantities of hazardous waste, nonhazardous noncombustion solid waste, and used oils would be generated during construction. These impacts are discussed in Section 4.18.1.3, Combined Impacts, due to the similarity of construction and operational activities for all phases of the project.

4.18.1.2 Operational Impacts

Generation Facility

A listing of the nonhazardous noncombustion solid wastes generated by the operation of the RHGF is provided in Table 4.18.1.2-1 along with their source processes, generation rate estimates, and the likely mode of disposal. These wastes include general refuse, water treatment wastes, air treatment wastes, chemical cleaning residues, and equipment maintenance residues. Several of these wastes (Table 4.18.1.2-1) would be disposed of in a state-approved landfill offsite.

Table 4.18.1.2-1 Nature and Quantities of Noncombustion Solid Waste Generated by Proposed RHGF Operation

Waste	Source Process or System/Composition	Quantity	Interval	Disposal
Refuse materials	Cardboard, filters, metal parts, packing materials, barrels, and office waste	15 yd^3	Biweekly	Offsite landfill
Magnesium oxide (MgOx) sludge	Cooling tower blowdown treatment	39 tons	Daily	Offsite landfill
Evaporator filter cake	Evaporator/Crystallizer	15.7 tons	Daily	Offsite landfill
Bed exchange resins	Spent demineralizer bed resins	10 bbl	Yearly	Offsite landfill
Spent silica desiccant	Air dryer	800 lbs	5 years	Offsite landfill
Oily refuse	Rags, dry oil, oil absorbed material from oil cleanup	3 bbl	Yearly	Offsite landfill
Water treatment filters	Reverse osmosis membrane systems	500 lbs	5 years	Recycle

Table 4.18.1.2-1 Nature and Quantities of Noncombustion Solid Waste Generated by Proposed RHGF Operation				
Waste	Source Process or System/Composition	Quantity	Interval	Disposal
Waste cleaner solvent	Degreaser and parts cleaner	55 gal	Bimonthly	Recycle
Glycol	Freeze protection systems	1 bbl	Yearly	Recycle
Used oil and waste solvents	Oil changes, lubrication, and equipment maintenance	500 gal	Yearly	Recycle
Used lubricating oils	Steam turbine bearings reservoirs	10,000 gal	3 years	Recycle
Chemical cleaning	Spent acid water from steam generator chemical	170 tons	3 years	Incinerate

[a] Noncombustion wastes are wastes that are not derived directly from combustion of the lignite.

By far the greatest quantities of nonhazardous solid wastes would be the residual ash, i.e., fly ash and bed ash, produced directly by the combustion of lignite either alone or mixed with small proportions (up to 5% on an energy basis) of wood waste (Table 4.18.1.2-2). Details of the process that produced these waste streams are presented in Section 2.2.1.

Table 4.18.1.2-2 Solid Waste Streams from the Combustion of Lignite by Circulating Fluidized Bed System at Red Hills Generation Facility				
Waste Stream	Generation Rate (tpy)	Classification	Comments on Composition	Disposal/ Management
Fly ash	598,585	Solid waste/ By-product	Non-hazardous	Onsite management /storage /marketing
Bed ash	66,540	Solid waste/ By-product	Non-hazardous	Onsite management /storage /marketing
Combined	838,715[a]	Solid waste/ By-product	Non-hazardous	Onsite management /storage /marketing

[a] Includes 29 % moisture for hydration of the fly ash for handling.

Notably, this discussion will be confined to the results and characterizations from the combustion of lignite alone, because calculations show that the contributions of wood waste to the mass of the fly ash and bed material (bottom ash) streams would be negligible. The ash content of the lignite is 15.25%, whereas the ash content of wood waste is only 0.3% (Burns and McDonnell 1997). Also, lignite and wood waste provide 5,485 Btus/lb and 3,506 Btus/lb, respectively. Calculations, using a contribution of 5% of combustion energy from the wood waste and the ash proportions given, show that the wood waste would contribute about 0.17% of the solids derived from the fuel combusted. This contribution is further diminished when limestone is included in the mix.

In the operation of a fluidized bed combustion system, the lignite is suspended along with limestone in a bed fluidized by entrainment in the air provided for the combustion process. The elevated temperatures convert the limestone to lime, which reacts with and traps the sulfur dioxide from the lignite as it is released within the bed, producing calcium sulfate and excess lime together with the common mineral residues (ash) from the lignite and small amounts of unburned lignite. The lighter and finer materials are

trapped in a bag house as fly ash. The coarser and heavier materials are collected in a hopper as bed material. The fly ash is conditioned with water to control fugitive dust and then combined with the bed ash for management.

Two leaching tests in particular have been used to represent the behavior of these ash residues using lignite and limestone from the project area following disposal in the environment, the EPA toxicity characteristic leaching procedure (TCLP) (US EPA 1997b) and the synthetic groundwater leaching procedure (SGLP) (Hassett et al. 1987).

The EPA TCLP is one of the regulatory methods used to distinguish between hazardous and nonhazardous wastes. It calls for the equilibration of a given quantity of waste with a prescribed quantity of dilute weak acid solution for 18 hours, followed by the analysis of the resultant leachate for selected potentially toxic trace elements, and then the comparison of these values against the RCRA limits. The SGLP has been proposed and is considered to be a realistic indicator of chemical concentrations likely to be sustained by the management of lignite combustion ash. The SGLP equilibrates the waste for 18 hours at the same solid/liquid ratio as the TCLP, but with deionized water instead of acid. The resultant leachate parameter concentrations can be compared directly with the primary drinking water standards.

Application of the EPA TCLP to fly ash and bottom ash from existing CFB generation facilities show these waste streams to be regulatorily nonhazardous (Table 4.18.1.2-3), as indicated by lower chemical parameter concentrations in the leachate as compared with the RCRA limits (Malcolm Pirnie 1997b). Application of the EPA TCLP test to ash residues from pilot scale CFB systems using lignite and limestone from the project area show the fly ash and the bed material (bottom ash) to be regulatorily nonhazardous also (Table 4.18.1.2-4) (Hassett et al. 1997).

Table 4.18.1.2-3 Leachate Data for Fly Ash and Bottom Ash from Existing Circulating Fluidized Bed (CFB) Power Plants[a]

General Characteristics	Texas New Mexico Power Plant (mg/L)		University of North Carolina-Chapel Hill (mg/L)		RCRA[b] Limits (mg/L)
Fuel Type	Lignite		Lignite		
Boiler Type	CFB		CFB		
Analysis	TCLP[c]		TCLP		TCLP
Parameter	Fly Ash	Bottom Ash	Fly Ash	Bottom Ash	
Arsenic	<0.02	<0.02	<0.02	<0.02	5.0
Barium	0.539	0.294	0.90	0.70	100.0
Cadmium	<0.005	<0.005	<0.005	<0.005	1.0
Chromium	0.013	<0.005	0.010	<0.010	5.0
Lead	0.08	<0.05	<0.05	<0.05	5.0
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	0.2
Selenium	0.07	0.02	0.02	<0.02	1.0
Silver	<0.005	<0.005	0.006	<0.005	5.0

[a] Data excerpted from Choctaw Generation Inc. Special/Industrial Waste Permit (Malcolm Pirnie 1997b).

[b] RCRA = Resource Conservation and Recovery Act

[c] TCLP = Toxicity Characteristic Leaching Procedure.

Table 4.18.1.2-4 RHGF Pilot-Scale Ash Leachate Data

Parameter	Fly Ash (mg/L)			Bed Material (mg/L)			Composite (mg/L)			RCRA[c]
	TCLP[a]	18-hr SGLP[b]	60-day SGLP	TCLP	18-hr SGLP	60-day SGLP	TCLP	18-hr SGLP	60-day SGLP	Limits (mg/L)
Arsenic	<0.008	<0.004	<0.004	<0.008	<0.004	<0.004	<0.008	<0.004	<0.004	5.0
Barium	0.92	0.32	0.26	0.12	0.31	<0.1	0.64	0.26	<0.1	100.0
Cadmium	<0.0003	<0.0003	<0.0003	0.00087	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	1.0
Chromium	0.22	0.18	0.24	0.20	0.11	0.53	0.21	0.21	0.32	5.0
Lead	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0027	0.0044	5.0
Mercury	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.2
Selenium	0.042	0.034	0.031	<0.008	<0.008	<0.008	0.042	0.036	0.023	1.0
Silver	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	5.0
Boron	<0.2	<0.2	<0.2	1.4	<0.2	<0.2	<0.2	<0.2	<0.2	NA[d]
Copper	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
Molybdenum	0.20	0.17	0.24	0.067	0.065	0.15	0.19	0.17	0.27	NA
Nickel	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	NA
Vanadium	<0.04	<0.04	0.12	0.20	<0.04	0.16	0.075	<0.04	0.26	NA
Zinc	<0.03	<0.03	<0.03	0.15	<0.03	<0.03	<0.03	<0.03	<0.03	NA
pH	11.7	12.4	11.8	6.05	12.2	10.6	12.3	12.3	11.03	NA

a TCLP = Toxicity Characteristic Leaching Procedure.

[b] SGLP = Synthetic Groundwater Leaching Procedure.

[c] RCRA = Resource Conservation and Recovery Act.

[d] NA = Not Applicable.

The SGLP tests were performed for the 18-hour equilibration and also for more extended periods of up to 60 days. The longer periods were intended to allow sufficient time for the anticipated formation of the mineral ettringite (a calcium aluminosulfate hydroxide hydrate) and its effect on the concentrations of certain trace elements to be manifested. The SGLP as applied to the pilot-scale fly ash and bed material (bottom ash) residues, separately and composited in realistic proportions, produced leachate parameter concentrations well below the RCRA limits. The trace element concentrations were in general very low, although in some instances the primary drinking water standards for barium (2 mg/l) and for chromium (0.1 mg/l) were exceeded (Tables 4.18.1.2-4).

The low concentrations observed are consistent with Electric Power Research Institute (EPRI) research which has shown that toxic metals or metalloids such as chromium, cadmium, arsenic, and selenium are present in lignite combustion ash wastes in forms that have low solubility. Also, other metals such as lead, mercury, and silver do not leach appreciably because of their low concentrations in the ash and their presence as insoluble compounds (Murarka 1991).

Constituents that do leach from the stored or disposed waste are still subject to a number of attenuation processes within the soil below, before they could reach the groundwater. These include adsorption and solid-phase precipitation reactions that represent complex physical and chemical interactions between the soil/geologic matrices and the hydrogeochemical environment. Finer-grained soils such as silts and clays, because of greater specific surface and composition, tend to be greater attenuators than coarser soils, such as sands, with pH and oxidation-reduction potential exerting significant modifying roles.

This attenuation would be enhanced by the proposed installation at the ash management unit of an 18-inch liner of recompacted clay with an in-place hydraulic conductivity of 1×10^{-7} cm/sec. This liner would be placed at the bottom of the ash management unit and would be located between the stored fly ash and bed material and the existing groundwater. Thus, the liner would effectively restrict/prevent the downward movement of leachate to the groundwater below.

An additional consideration is the option of using brine concentration to wet the fly ash. The brine concentrate may have as much as 30,000 mg/L total dissolved solids (TDS). Based on the source water composition, received from the RHGF, it is likely that for the concentrate, the cations will be primarily sodium and potassium and the anions primarily chloride. The concentrate may constitute as much as 29% of the fly ash by weight.

An obvious alternative to onsite long-term storage is the beneficial use ash. Areas in which these materials have found applicability include agriculture - as a liming agent; and building and structural materials – as an inclusion in cement and concrete (Tyson et al. 1997a and b; Tyson et al. 1995a and b; Taylor 1990; Lees et al. 1988) or as a soil amendment.

Mine

A listing of the nonhazardous solid wastes generated by the operation of the mine is provided in Table 4.18.1.2-5 along with their source processes, generation rate estimates, and the likely mode of disposal.

Table 4.18.1.2-5 Nature and Quantities of Used Fluids and Nonhazardous Solid Waste Generated by the Proposed RHLM Operation

Waste	Source Process or System/ Composition	Annual Generation Rate	Disposal
Used lubricating oil	Equipment maintenance	18,000 gals	Recycle
Used hydraulic fluid	Equipment maintenance	4,500 gals	Recycle
Used coolant	Equipment maintenance	2,000 gals	Recycle
Used solvent	Parts Cleaning	200 gals	Recycle
Office/shop trash	Paper, cardboard, lunch room food, garbage, etc.	5-10 tons	Offsite landfill
Select mining rubbish	Demolition debris	20-50 tons	Onsite mined-out pits

Most office and shop wastes generated at the mine site would be placed in dumpsters for removal by a local waste disposal contractor for final disposal at a local landfill. These wastes would include lunchroom garbage, paper, cardboard, plastic packaging, and empty cans and bottles. Shop rags would be completely wrung out before disposal. MLMC would actively encourage recycling, and would explore recycling opportunities for aluminum cans, paper, cardboard, scrap metal, and plastic.

Intermittent disposal of other select mining rubbish would occur in mined-out pits. Only rubbish that is generated onsite, during mining activities, would be disposed of in this way. No waste from outside the mining operation would be disposed of in mined-out pits. Disposal would occur only on lands permitted for mining and owned by the mine.

Rubbish disposed of in mined-out pits would come primarily from cut-over forestland, old residences, farm buildings, and other structures being mined. It is currently projected that there would be less than five buildings mined through during the first five years of the operation, and less than about 40 over the entire life of the mine. Also, large equipment packaging material that is too big for disposal in dumpsters would be placed in mined-out pits.

Wastes expected to be disposed of in mined-out pits include the following.

- Demolition debris, including wood, and metal, scraps, sheetrock, wiring, and non-asbestos insulation from abandoned residences, old farm buildings, sheds, and similar structures.
- Scrap piles of wood, glass, metal, and crockery near abandoned residences being mined (except empty containers, such as old oil barrels, pesticide containers, and bottles of liquids).
- Appliances (except refrigerators and air conditioners) and furniture from abandoned residences (if county recycling programs exist for whiteware, these would be used in lieu of disposal).
- Brick, mortar, concrete, stone, and asphalt from abandoned residences and storage areas.
- Old wood and wire fences.
- Mine site construction debris, such as large cardboard or wood boxes, wood and metal scraps, and paper packaging, and pallets.
- Cut over timber scraps and slash, including stumps, trunks, limbs, leaves, and brush.
- Old powerpoles (but not transformers) and electrical lines, used electrical cable, old telephone lines and empty water mains, scrap polyethylene and PVC water pipes, and used dragline and shovel cables.
- Scrap metal pieces from heavy equipment that would be too large to be recycled.
- Unregulated off-road heavy equipment tires that would otherwise not be recyclable; this may include blown out, slashed, or destroyed tires and tire pieces.

The disposal of these types of solid wastes in mined-out pits is a commonly accepted practice within the mining industry. Moreover, for the proposed RHLM, significant underburden sands are separated from the mine floor by thick (80 to 100 feet), low hydraulic conductivity clay, lignite, and silty clay layers (MLMC 1997). No mining activities, i.e., no mine pits, would extend into the significant underburden sands. Thus, it is very unlikely that any of the materials proposed for disposal within the mined-out pits will contribute to the degradation of the water quality within the significant underburden sands of the Lower Wilcox Aquifer.

The MDEQ would be contacted for approval to dispose of materials other than those described should the need arise.

It is expected that 20 to 50 tons of this rubbish (other than stumps, tree trunks, limbs, brush, and other vegetative waste) would be disposed annually in mined-out pits, depending on the amount of residential building debris encountered during mining. All rubbish would be covered with spoil, and buried deeply enough that it would cause no problems with reclamation at the surface.

If suitably sized, used brick, concrete block, and cured concrete could be used for riprap and eventually buried during reclamation. This would be at pond inlets or along erosive drainageways.

A qualified asbestos removal contractor would remove asbestos from abandoned residences. Batteries would not be buried in mined-out pits, but would be recycled or sent to a qualified disposal facility.

Transmission Line and Natural Gas Pipeline

Operation and maintenance of the utility corridors are discussed in Section 4.18.1.3 and are expected to have an insignificant impact.

4.18.1.3 Combined Impacts of Generation Facility and Mine

Solid Waste from Construction Activities – Nonhazardous solid waste from construction activities include:

- vegetation,
- broken concrete,
- rock,
- scrap lumber,
- scrap metal, and
- packing materials.

It is expected that any economic wood from this primarily forested area would be harvested prior to the initiation of any other clearing activities. Clearing and grubbing the area of the remaining brush, shrubs, and noneconomic trees would result in vegetative waste. For the RHGF, this waste would be burnt onsite pending approval by the appropriate state environmental agency, and most of the remaining waste listed would be disposed of in an approved solid waste landfill offsite. For RHLM, most of the rubbish accumulated during the initial construction and facilities development would also be disposed of similarly. However, waste comprised of large items such as brush and tree piles, rocks, concrete, and destroyed structures, generated ahead of the first pit, would be stockpiled in a secure area near the anticipated location of the first pit. The stockpile could be retained for up to one year, until the pit were opened and available to receive these wastes.

A listing of state-approved solid waste landfills in the vicinity of the project area is provided in Table 4.18.1.3-1 below. Information provided in the table indicates that there would be adequate disposal capacity within economic distances of the generation facilities and mine. Other wastes would be managed as indicated in Tables 4.18.1.2-1 and 4.18.1.2-5, respectively. The proper disposition of these nonhazardous wastes in or by state-approved disposal facilities, or the recycling facilities, makes it clear that the generation and disposition of these wastes would pose no adverse impacts to the environment.

Table 4.18.1.3-1 Available Solid Waste Disposal Capacity Near the RHPP Project Area						
	City of Louisville Landfill	City of Durant Landfill	Prairie Bluff Landfill	Golden Triangle Regional Landfill	Three Rivers Regional Landfill	Leflore County Sanitary Landfill
County	Winston	Holmes	Chickasaw	Clay	Pontotoc	Leflore
Distance to Disposal Facility (miles)	18	38	40	45	65	70
Remaining Life of Disposal Facility (years)	5	1	25	50	2-3	18
Days of Operation	Mon-Sat[a]	Mon-Sat	Mon-Sat	Mon-Sat	Mon-Sat	Mon-Fri
Average Disposal Activity (tpy)	24,000	240,000	416,000	101,000	195,000	60,000
At Gate Disposal Cost ($/ton)	18	21	24	24	19.98	26[b]
Acceptance of Hazardous Waste	No	No	No	No	No	No
Acceptance of Special Waste	Yes[c]	Yes	Yes	Yes	Yes	Yes

a. Mon-Sat = Monday through Friday and half-day on Saturday.
b. Out-of-county rate.
c. Facilities accept special waste with written approval from the Mississippi Department of Environmental Quality.

Hazardous Waste – Only limited quantities of hazardous waste would be generated during the construction, operational, and maintenance phases of the generation facility, the mine, and the utility corridor. Although the quantities may differ, the various types, origins, and management of hazardous wastes from the construction phase would be similar to the ones for the operational phase.

Strict chemical control programs are planned for the RHGF and the RHLM to minimize the use of hazardous materials and the resultant generation of hazardous waste. Wherever possible, the use of hazardous chemical materials would be avoided, and nonhazardous substitutes utilized instead. The use of halogenated solvents would be discouraged and solvents would be recycled wherever feasible. These programs would be supported by appropriate training of the employees.

Extrapolation from the experience with similar existing generation facility-mine complexes suggests that the RHGF and the RHLM would each be no greater than an Environmental Protection Agency (EPA) Conditionally-Exempt Small Quantity Generator or Small Quantity Generator, i.e., generating less than 100 kg of hazardous waste per calendar month. The RHGF and RHLM would each be registered independently as hazardous waste generators. Little or no hazardous wastes are anticipated from the construction and operation of the utility corridor.

It is likely that during the construction phase there would be a higher proportion of paint-related wastes than during the operational phase. Waste solvents, hazardous on the basis of toxic and/or flammable properties, would probably be produced by degreasing and other equipment-maintenance activities. Waste paint and thinners would be generated by the common painting activities. Waste oil that is

considered spent oil is hazardous by the presence or inclusion of hazardous solvents and/or hazardous trace metals transferred by use from gears and other metal parts.

Any hazardous waste generated by the RHGF and the RHLM would be stored onsite only temporarily (less than 90 days) and managed there in accordance with the applicable EPA Resource Conservation and Recovery Act (RCRA) regulations (40CFR265) (US EPA 1997a). Hazardous waste would be hauled by a licensed transporter to an approved hazardous waste disposal facility. A survey of the area shows the nearest commercial disposal facility to be the Chem Waste Management (CWM) facility in Emelle, Alabama. This disposal facility is appropriately licensed and accepts wastes from out-of-state. It has capacity for as long as 10 to 20 years at approximately 800,000 tons per year for disposal by stabilization and landfilling. Hazardous waste properly handled onsite, transported by a licensed transporter, and disposed of at an approved facility with adequate disposal capacity, such as CWM, would have little or no environmental impact.

Used Oil – In the construction phase, used oil would result from oil changes from equipment maintenance for activities associated with the generation facility and the mine. Used oil would be sent to a recycler offsite for processing. Little or no used oil is expected in association with construction of the transmission line or natural gas pipeline.

In the operational phase, used oil would again result from oil changes from equipment maintenance for both the generation and the mine facilities. Used oil from these types of oil changes would be less than 500 gallons per year for the RHGF operation (Table 4.18.1.2-1) and about 22,500 gallons per year for the RHLM (Table 4.18.1.2-5). Some used oil could be also expected from oil changes on equipment used to clear the utility corridor.

For the operational phase of the RHGF, greater quantities of used oil would result from oil changes associated with the steam turbine bearing reservoirs, i.e., about 10,000 gallons every three years (Table 4.18.1.2-1). There is no equivalent source and quantity of used oil resulting from the mining activities. Used oil would be sent to a recycler offsite for processing. Little or no used oil is expected in association with operation or maintenance of the utility corridor. Used grease generated by the RHLM from the draglines and shovels would be mixed with used oil for recycling or sent offsite to a grease recycling facility.

Useable Product – Bulk storage of useable petroleum products would be required at the RHGF and RHLM sites. Diesel fuel, gasoline, lubricating oil, and hydraulic oil, would be stored in aboveground tanks as listed in Table 4.18.1.3-2.

Table 4.18.1.3-2. Bulk Storage of Petroleum and Other Products at Proposed RHGF and RGLM Sites.

Facility	Product	Individual Tank Volume (gal)	Number of Tanks	Use
RHGF	Diesel fuel	500	1	Fire pump tank
RHGF	Diesel fuel	500	1	Diesel generator tank
RHGF	Lube oil	3,500	1	Turbine oil tank
RHLM	Diesel fuel	50,000	2	Equipment/vehicle fueling
RHLM	Gasoline	1,000	1	Vehicle fueling
RHLM	Lube oil	1,000	2	Motor oil
RHLM	Hydraulic fluid	1,000	1	Hydraulic equipment

In addition to the items listed in this table, it is expected that small quantities of specialty nonhazardous lubricants would be stored in smaller containers, such as 55-gallon drums, at the RHLM. The storage of the listed volumes of the petroleum products exceed the threshold volume that would require the RHGF and the RHLM to each develop and follow a Spill Prevention Control and Countermeasure (SPCC) Plan.

The SPCC Plan would spell out the appropriate measures and actions that a facility would adopt to prevent, contain, and cleanup spills of petroleum products for the protection of waters of the U. S. Relevant measures would include the provision of secondary containment for bulk storage tanks, the use of fuel nozzles with automatic coupling systems such as a Wiggins system to reduce leaks during fueling, the use of sorbents to control and cleanup leaks/spills, the availability of ponds to contain large spills, routine inspections for leaks, corrosion and other problems, and the training of facility personnel to perform these activities adequately. Further examples of the environmental control practices and training planned for the mine are detailed in the mine permit application.

Other materials of concern onsite would include small quantities of paints, cleaners, adhesives, and other chemicals. Wherever appropriate, these containers would be stored in fire-proof cabinets or otherwise stored and used with due concern for any potential hazards.

4.18.2 No Action Alternative

Without the project, there would be no significant impacts, other than the current trend of industry growth in Choctaw County. In the event the generation facility and mine were built and operated independent of TVA's involvement, the impacts would be expected to be similar to those described in this EIS.

4.19 Noise

4.19.1 Action Alternative (Project as Proposed)

Impacts of environmental noise exposure on people come from potential hearing loss and annoyance as described in Section 3.19.1. Appendix D-5 presents the evaluation criteria used to assess the magnitude of hearing loss impact on an exposed population and to estimate the annoyance that comes from communication interference and general disturbance caused by intruding environmental noise.

4.19.1.1 Construction Impacts

Generation Facility

Hearing Loss – This estimation of the potential impact of environmental noise from the construction of the RHPP is based on historical noise emissions data and the assumption that it applies to this review. It is reasonable to approach the estimation this way because it would be timely and economically impractical to attempt to generate similar representative data through a measurement and verification effort. The construction noise emissions data used in this review come from the EPA publication, "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances" (Bolt, Beranek, and Newman 1971).

An industrial construction project can be viewed as having five phases identified below.

- Site preparation including clearing and demolition if necessary.
- Excavation to grade and contour.
- Construction of foundations.
- Erection of above grade structures.
- Finishing of structures and site.

The overall noise emissions from each of these phases depend on the numbers and type of equipment used in their respective activities. Site preparation uses heavy equipment such as bulldozers and backhoes. Grading and contouring a site uses bulldozers, scrapers, heavy haul trucks, and graders. The foundation construction needs backhoes, pile drivers, cranes, jack hammers, and bulldozers. Erection above grade uses cranes, forklifts, and construction tools. Finishing of the structures requires painting compressors, fork lifts, and cranes. During all of these phases there would be many types of trucks on site. Typical noise emissions from this type of construction equipment can be found on Table 4.19.1.1-1.

Table 4.19.1.1-1 Construction Equipment Noise Emissions

Equipment Description	Noise Emissions at 15.4 m (50 ft) dBA1.
Scrapers	80 - 94
Front End Loaders	73 - 85
Backhoes	73 - 94
Graders	80 - 94
Trucks	83 - 94
Derrick Cranes	86 - 88
Mobile Cranes	76 - 87
Rock Drills	82 - 98
Pile Drivers	95 - 106 (peak)
Compressors	75 - 87
Jack Hammers	82 - 98
Dozers	88 - 982.

1. Data from, "Construction Equipment and Operations, Building Equipment, and Home Appliances," Bolt, Beranek, and Newman 1971.
2. Calculated from estimated horsepower of typical dozers, 400 to 1200 horsepower. Beranek, L. L., and I. L. Vér, Noise and Vibration Control Engineering, John Wiley and Sons, Inc. New York, 1992 (Beranek and Vér 1992).

Also in its document (Bolt, Beranek, and Newman 1971), EPA estimated the noise emissions for each phase of construction previously described. These estimates used a typical selection of construction equipment and their respective noise emissions from Table 4.19.1.1-1. Also, operating factors were included for the equipment. An operating factor is the percentage of time during the work shift that the equipment is actually being used and not shut down or at idle. For example, during site excavation the pan scrapers and graders would have a high operating factor of 80 to 90 percent, whereas a water truck might have an operating factor or 20 to 30 percent. The average noise emissions for each phase of construction are given in Table 4.19.1.1-2. These noise emissions averages are for work shifts. When construction activity stops the noise would drop to general background levels. Also given in Table 4.19.1.1-2, are the Leq exposure level and L_{DN} of the closest residence to the generation facility construction site and the distance to the 70 dBA Leq level that EPA uses as the lifetime hearing loss threshold. The L_{DN} calculation assumed only daytime construction of the facility between 0700 and 2200.

Table 4.19.1.1-2 Construction Phase Noise Emissions and Receptor Exposure Levels from the Generation Facility Construction

Construction Phase	Noise Emissions L_{eq} at 15.4 m	Sound Power L_w	Exposure L_{eq} at Closest Receptor 1100 m (3600 ft)	L_{DN} at Closest Receptor	Distance to 70 dBA L_{eq}
Site Prep.	84 dBA	119	43 dBA	41 dBA	282 m
Excavation	89 dBA	124	48 dBA	46 dBA	501 m
Foundation	78 dBA	113	37 dBA	35 dBA	141 m
Erection	85 dBA	120	44 dBA	42 dBA	316 m
Finishing	89 dBA	124	48 dBA	46 dBA	501 m

In order to project the noise level at the closest receptor in Table 4.19.1.1-2 the sound power (L_W) of the construction phase noise emissions was calculated using the method described in the following (Harris 1991).

$$L_W = L_r + 20\log_{10}r + 10.9 + C$$

Where: L_r = construction phase noise emissions at 15.4 m (50 ft)

$20\log_{10}r$ = attenuation from geometric divergence

10.9 = constant for SI units

C = temperature and pressure variable, equals 0 at standard conditions

The L_W was then used to calculate the projected noise at the closest receptor using the method given in Beranek and Vér (1992).

$$L_R = L_W - 20\log_{10}R - 10.9 + K_\Omega - K_{air} - K_{ground}$$

Where: L_R = sound pressure level at distance R to the closest receptor

$20\log_{10}R$ = attenuation from geometric divergence for distance R

10.9 = constant for SI units

K_Ω = 3, constant for hemispheric noise propagation

K_{air} = 3, atmospheric attenuation for distances >200 m

K_{ground} = 4.7, ground attenuation for acoustically soft ground and > 600 m

Note: Discussions of hemispheric noise propagation and atmospheric attenuation are in Beranek and Vér (1992), and geometric divergence and ground effects attenuation are found in Harris (1991).

It can be seen from Table 4.19.1.1-2 that none of the construction phases cause a projected noise level of 70 dBA at the closest receptor. These exposure levels would cause no impact on the lifetime hearing loss of the residents at the closest receptor to the generation facility construction.

Annoyance – The measures of annoyance presented in Appendix D-5 are all based on knowing the intruding noise levels and the populations exposed to them. For example, the annoyance reporting percentages given in Appendix D-5 are multiplied by the exposed population to give the number of people potentially impacted.

Interference with communication usually happens outdoors and sometimes indoors if the intruding noise is loud enough. Sentence interference rates are given in Table D-5.2. At outdoor L_{DN}'s of less than 50 dBA, the EPA guidance document predicts that there will be no speech interference (Office of Noise Abatement and Control 1974). Table 4.19.1.1-2 gives the intruding L_{DN}'s at the closest receptor for each construction phase. Since these range from 35 to 46 dBA and are below the 50 dBA level where speech interference begins there would be an insignificant impact on communications.

The background L_{DN}'s for the closest receptors along Highway 9 are in the range of 56 to 61 dBA, sites 2, 5, and 7, Table 3.19.4-1. These are substantially higher than the predicted intruding L_{DN}'s of 35 to 46 that show a very low self-reporting rate of annoyance from Table D-5.3. If any annoyance is reported from the intruding construction noise, it probably will not be caused by its level. These low intruding levels will not add significantly to the ambient noise levels.

Appendix D-5 presented qualitative or subjective variables that could influence the impact of construction noise on the exposed populations. This impact can not be quantified. It should be expected that one or more individuals will claim some type of noise impact regardless of their exposure level. If there is significant community response to this project it will probably be caused by these subjective variables since the projected intruding noise is substantially less than the measured background noise.

Based on this information, the annoyance impacts from construction of the generation facility would be insignificant.

Mine

Hearing Loss – Construction of the mine would be similar to phase two of the generation facility construction, excavation to grade. The closest receptor to the first year of mining activity is between about 750 m and 1,525 m, depending on where the construction of the mine is underway. Using the calculation method above, at 750 m this receptor could be potentially exposed to a Leq of 51 dBA outdoors, and at 1,525 m, the level would be 47 dBA. Noise emissions from the first year of the mine construction should have no hearing loss impact on residents in the project area.

Construction for lignite mining in project year 29 will begin about the calendar year 2027 or 2028. This is the mining area closest to the Jeff Busby developed area and Little Mountain Overlook area of the Natchez Trace Parkway. This construction will be about 500 to 600 m from the overlook and about 1,100 to 1,200 m from the campground and ranger's residence in the developed area. The projected construction noise levels at these locations are about 54 and 48 dBA, respectively. The noise level at the campground and ranger residence will probably be lower because the acoustic shielding of Little Mountain was not considered in the projection. Neither of these levels would impact hearing loss of people at the Little Mountain Overlook or in the Jeff Busby developed area.

The mine also requires the construction of sedimentation ponds. These will be built at various locations as the mining progresses through the life of the project. Construction of the ponds will require excavation to the proper contour and depth. This work will have similar noise emissions as the phase 2 construction discussed previously. At times during this construction there could be residences within the 501 m, 70 dBA Leq coverage area. Even within this coverage area, there will be no significant impact to the hearing loss on residents because of the very short construction periods for the sedimentation ponds.

Annoyance - The L_{DN} levels of the intruding construction noise are projected to be about 45 to 49 dBA at the closest receptor. These levels are substantially below the 56 to 61 dBA background L_{DN}'s at sites 2 and 7, Table 3.19.4-1. This intruding noise would not interfere with outdoor communications because it is below 50 dBA. Also, because the intruding noise level is low and substantially less than background, any self-reported annoyance would probably come from subjective reasons and not the noise level.

Intruding L_{DN} levels at the Jeff Busby developed area for mine construction in year 2028, would be 46 or less dBA at the campground and ranger's residence and 52 dBA at the Little Mountain Overlook. Both of these are substantially less than the 60 dBA background L_{DN} level at the Overlook. The intruding noise would not add any speech communication interference at these locations. Because of the large difference between the projected intruding noise and the background noise at the campground and ranger's residence there should be no annoyance reported. The L_{DN} level at the Overlook indicates that there could be some annoyance reported. This would be insignificant because of the transient nature of the short-time visitors at the Overlook.

Potential annoyance from the construction of the sedimentation ponds would be insignificant. The very short construction time for the ponds would mitigate the potential impact.

Transmission Line and Natural Gas Pipeline Corridors

Hearing Loss – Construction of the transmission line and natural gas pipeline will not impact the potential hearing loss of adjacent residents. The construction sites for these services rapidly move, and the amount of activity and equipment would be much less than for the construction of the generation facility and mine. Although the closest noise receptor on any given day might have an exposure of 70 dBA or higher, it would occur for only a few days and not be harmful to the lifetime hearing loss of the residents. It is not expected at anytime that the short-term noise exposures will be high enough to approach the occupational limits.

Annoyance – As with the discussion of hearing loss from constructing the transmission line and natural gas pipeline, the annoyance impact will be minimal. There could be some annoyance to the closest receptors on any given day of construction of these services. This annoyance could last from one to a couple of days. As the construction sites rapidly move, different residents could be annoyed, but the annoyance for others would end. Overall, this would be an insignificant impact.

4.19.1.2 Operational Impacts

Generation Facility

Estimation of the environmental noise impact from the operation of the generation facility is based on the noise emission information found in Electric Power Plant Environmental Noise Guide, 2nd Ed., (Miller et al. 1984) published by the Edison Electric Institute (EEI). Noise emission data in this guide were compiled from several sources, including: available literature; authors' project files; equipment manufacturers; EEI member utilities; and special field trips for data collection. These data were used to model (Hunt 1997) the projected noise levels in the surrounding area. The generation facility noise

sources and their respective sound power levels that were used in the modeling are given in the following Table 4.19.1.2-1. Figure 4.19.1.2-1 gives the relative spatial arrangement of the generation facility used in the modeling.

Table 4.19.1.2-1 Intruding Sound Levels from Generation Facility at Closest Receptor, Highway 9

Noise Source	Sound Power L_w dBA	Distance, m (ft)	Sound Level dBA
Turbine Building, includes turbine, generator, and exciter	100	1100 (3609)	17
Boilers 1 and 2 (total of 2 boilers)	112	1050 (3445)	29
Boiler stack, including baghouse	119	1000 (3281)	20
Transformers	101	1200 (3937)	24
Coal and limestone crushing and handling building	123	800 (2625)	50
Cooling tower	127	1000 (3281)	41
Total	129		51

Vibranalysis Engineering Corporation (Hunt 1997) completed the computer modeling used to project the operational noise emissions from the generation facility and lignite mine. Hunt (1997) used two models, CONCAWE® (Marsh 1982) and SOUNDPLAN® (Braunstein and Berndt 1994). These models used the sound power levels given in Table 4.19.1.2-1, the generation facility layout in Figure 4.19.1.2-1, and the topography of the project areas.

Hearing Loss – Hearing loss evaluation criteria are the same for operations as they were for construction and are discussed in Appendix D-5. The noise emissions of each major noise source in the generation facility complex, given in Table 4.19.1.2-1, were modeled to the closest receptors on Highway 9. Figure 4.19.1.2-2 shows the noise coverage areas from the generation facility operations and the location of the nearest receptors. Table 4.19.1.2-1 presents the intruding noise levels from the generation facility at the Highway 9 receptor sites.

Figure 4.19.1.2-1 Generation facility noise sources.

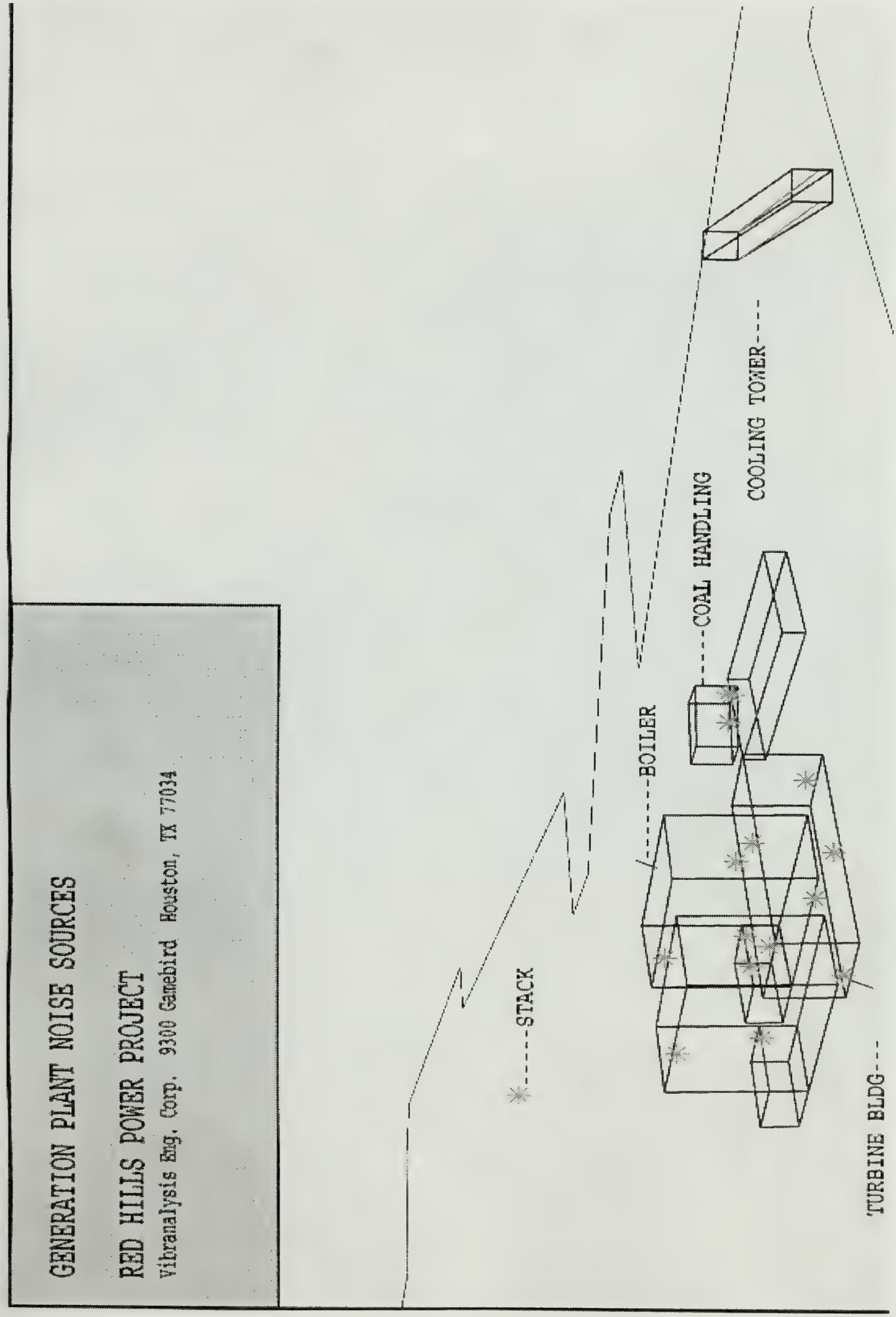
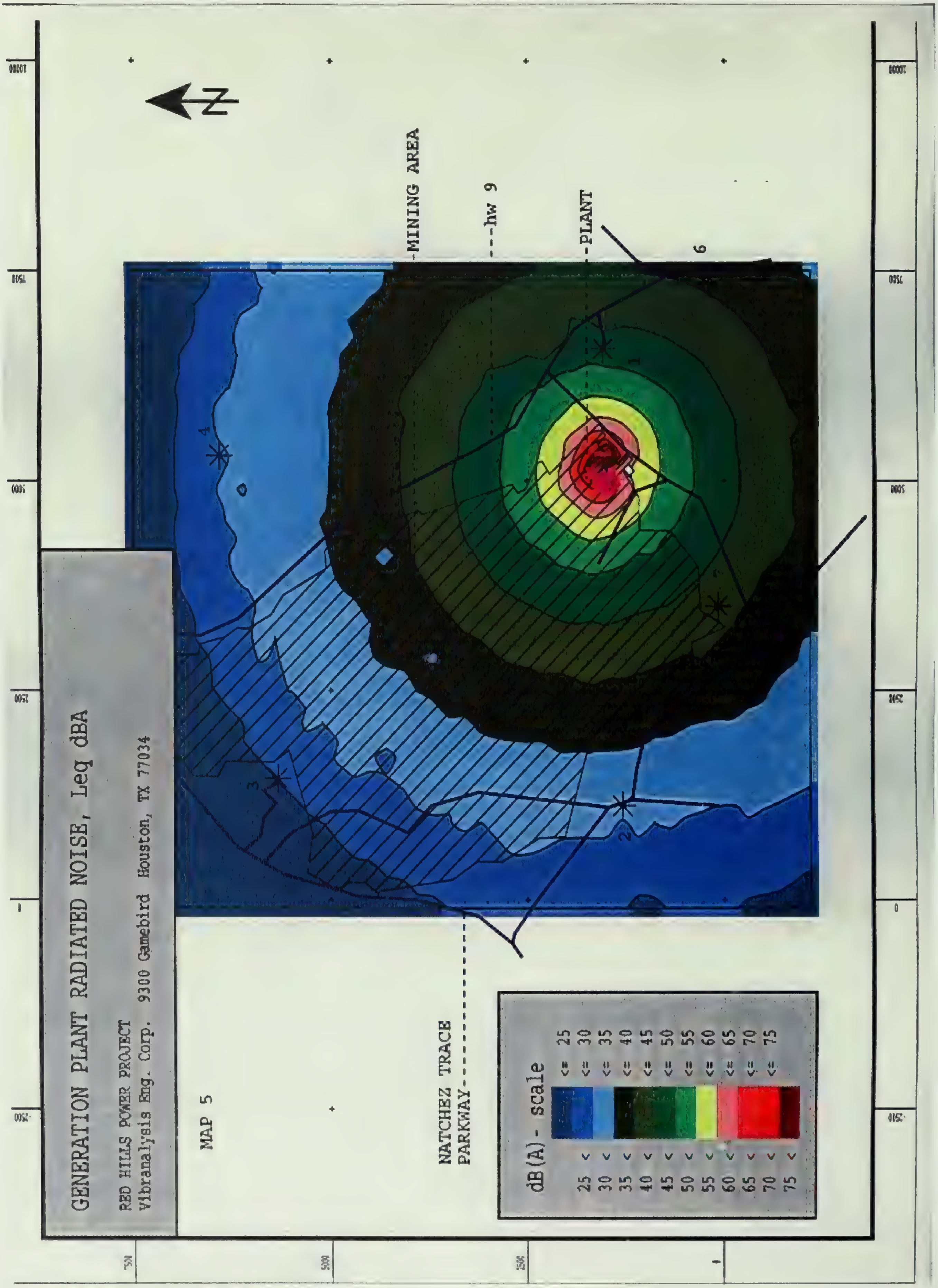


Figure 4.19.1.2-2 Noise coverage areas and receptor locations for generation facility.



The total intruding $L_{eq}(24)$ at the closest receptors is 51 dBA. This is well below any criteria for hearing loss. There would be no hearing loss impact from the operation of the generation facility.

Annoyance – Potential annoyance from the generation facility's operational noise emissions is a 24-hour per day concern. As a base load electrical power generating station, it will not shut down on a daily cycle although it might derate its output during low use periods. At the closest noise receptor, about 1,100 m from the generation facility, the L_{DN} is 57 dBA calculated from the modeled 24-hour sound level of 51 dBA in Table 4.19.1.2-1. Projected distances to the 55 and 50 dBA L_{DN}'s are 1,450 m and 2,580 m, respectively.

The potential sentence intelligibility interference rates are 0.5% at 50 dBA and 1% at 55 dBA, from Table D-5.3. These interference rates could effect an estimated 111 to 142 people at 50 dBA and 23 to 30 people at 55 dBA during outdoor activities. Generally, these low interference rates are insignificant. People readily adapt to small interferences in conversation by moving a little closer or speaking slightly louder. This intruding L_{DN} is about the same level as the background L_{DN}'s of 56 to 60 dBA measured near the closest receptors, sites 1 and 5, Table 3.19.4-1, which further mitigates their possible impact on communications.

Self-reported annoyance from the generation facility operations is estimated by multiplying the reporting rates times the predicted populations. Table 4.19.1.2-2 presents the estimated number of people who would be predicted to self-report annoyance at the intruding noise from the generation facility operation.

Table 4.19.1.2-2 Estimates of Self-Reported Annoyance from Generation Facility Operations

L_{DN}	Distance, m	Predicted Population[1.]	Reporting Rate %	Estimated Number People
60 dBA	815	0	13	0
55 dBA	1450	30(23)	9	3(2)
50 dBA	2580	111(142)	6	7(9)

1. First number is from the occupied houses times 3 people per house, and second number is from the coverage area times the Choctaw County average population density of 21.6 people per square mile.

The estimated number of people who would potentially self-report annoyance at noise levels of 50 dBA and below is questionable. These L_{DN}'s are well below the background L_{DN}'s, and the impact of the intruding noise would be unpredictable. At the 55 dBA L_{DN} level, the predicted population in the coverage area is small. These people will hear the generation facility operations some of the time, especially when they are outdoors in the winter, which is the quiet time of the year. Based on these intruding noise levels the community response should be minimal. There could be sporadic complaints, but they are expected because of subjective reasons also.

The noise coverage areas and exposed population at EPA's guideline of L_{DN} of 55 dBA or higher are small. The potential impact to the overall public health and welfare from the generation facility operations should be insignificant.

Mine

Noise emissions data for mine operations were set based on the specified mining equipment (MLMC 1997), and were also modeled by Hunt (1997). The following Table 4.19.1.2-3 presents the specified equipment, number of each type of equipment, and the respective sound power levels.

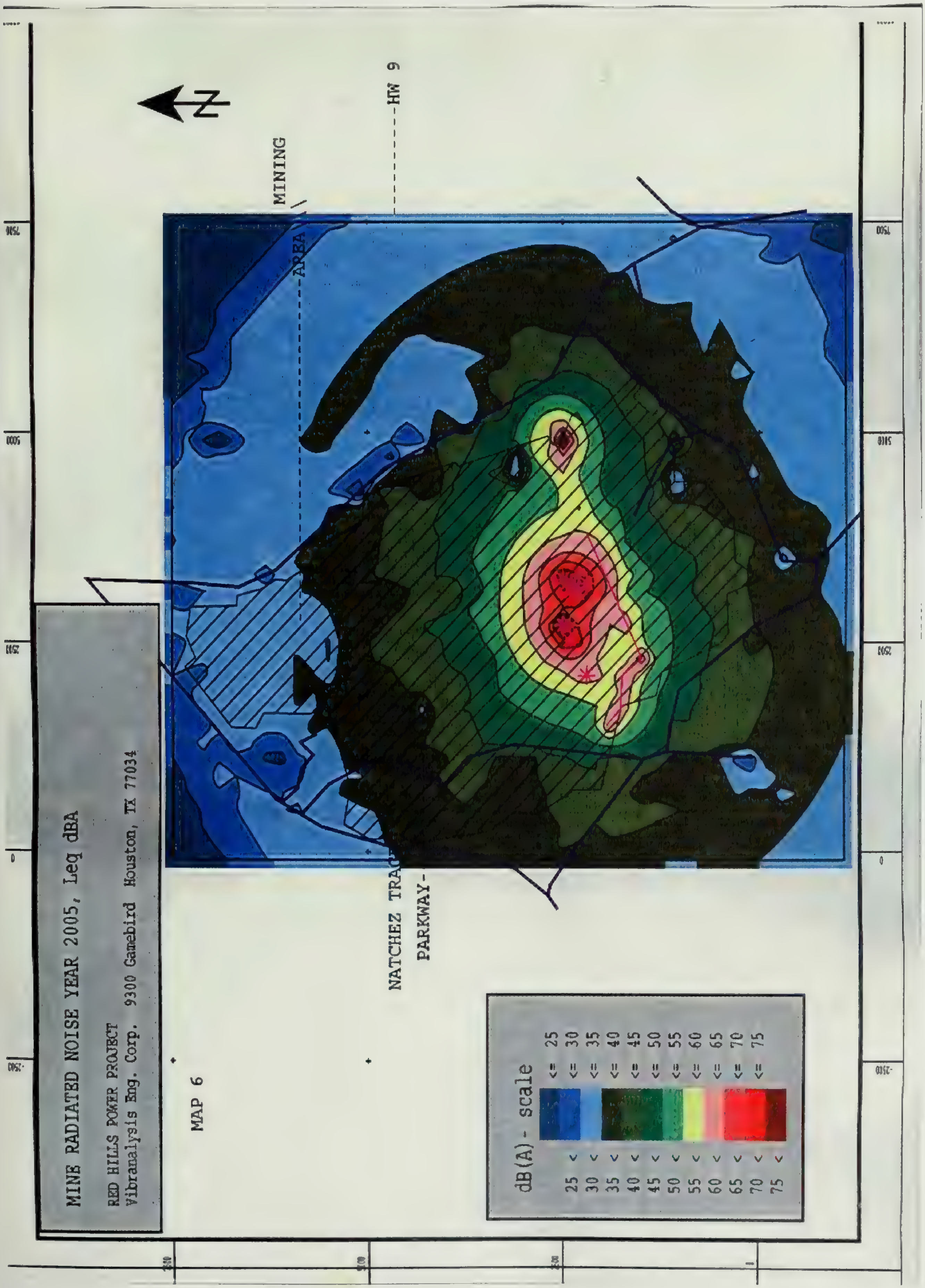
Table 4.19.1.2-3 Mine Noise Sources and Sound Power Levels

Equipment Description	Number of Units	Sound Power L_w (dBA)
M8200 Electric Dragline, 8000 hp	1	108
M201 Electric Shovel, 2000 hp	1	110
5130 Diesel Backhoe Loader, 755 hp	1	108
944 Diesel Loader, 1250 hp	1	108
785 Diesel Haul Trucks, 1290 hp	6	109
D11 Diesel Bulldozer, 850 hp	3	115
D10 Diesel Bulldozer, 570 hp	2	113
D7 Diesel Bulldozer, 230 hp	1	111
637E Diesel Scraper, 950 hp	2	120
16H Diesel Grader, 275 hp	2	116
773 Diesel Water Truck, 650 hp	2	110
8343 Diesel Rubber Tire Dozer, 450 hp	1	110
350 Diesel Backhoe, 286 hp	1	108
416B Diesel 1D Hoe, 78 hp	1	108
Diesel Lignite Crusher, 1000 hp	1	116

Hearing Loss – Modeling of the noise emissions from the mine operations was separated into two noise source locations. The mine pit where the electric shovels, loaders, bulldozers, and haul trucks operate; and the mine surface where the haul trucks, lignite crusher, and reclamation equipment operate. Graders, water trucks, and other equipment cover the entire mine operating area. As a worst case, the mine noise emissions modeling used all of the equipment listed in Table 4.19.1.2-3 divided between these locations and a 100% operating factor. Noise propagation modeling was done for two operating years, 2005 and 2028, as being typical of the mining being done at the extreme locations of the project area. The projected noise for the mine operations is for 20 hours per day instead of 24. The $L_{eq}(24)$ is about 1 dB less than the 20 hour L_{eq}.

The intruding noise in the Chester area is expected to be about 40 dBA from the mine operations in the year 2005. Closest receptors this year would be the residences along Highway 415, about where the current TVA transmission line crosses the highway. The intruding noise level there would be in the 45 to 50 dBA range. These levels would have no impact on the potential hearing loss of the residents. Figure 4.19.1.2-3 shows the projected noise emissions from the year 2005 mining.

Figure 4.19.1.2-3 Projected mine noise emissions, year 2005.



Year 2028 mining is about 3,800 m (2.4 mi) to the north-northwest of the year 2005 mine operations. This would be within 500 to 600 m of the Little Mountain Overlook of the Natchez Trace Parkway. Figure 4.19.1.2-4 presents the mining location along with the projected noise emissions levels. At the Little Mountain Overlook, noise levels as high as 45 dBA are expected. Figure 4.19.1.2-5 shows the detailed noise emissions modeling for the Jeff Busby developed area and Little Mountain Overlook area of the Natchez Trace Parkway. These projected noise levels are for an intermediate mining depth of about 100 feet below natural grade.

It is difficult to identify where the closest residential receptor would be located in year 2028 because of possible reinhabitation of formerly mined land. The nearest residences that would not be displaced by the mining are about 1,600 m (1 mi) to the east-northeast along Highway 9. Also, the ranger's house and campground at Jeff Busby developed area of the Natchez Trace Parkway are about 1,100 to 1,200 m (0.7 mile) from the year 2028. Residents along Highway 9 would experience intruding noise levels as high as 40 dBA, and at the ranger's residence and campground it could be as high as 35 to 40 dBA. The mining noises at the ranger's residence and Jeff Busby campground are substantially shielded by Little Mountain Overlook. These noise levels will not impact the hearing loss of the residents, ranger, or campers.

<u>Annoyance</u> – The modeling of the noise emissions from the lignite mine operations was discussed in the Hearing Loss section. The worst case noise coverage for the mining year 2005 would be in the Highway 415 area about where the current TVA transmission line crosses, see Figure 4.19.1.2-3. Here the 20-hour equivalent sound level is in the 45 to 50 dBA range. This range calculates into a L_{DN} range of about 49 to 54 dBA. There are about eight occupied residences along this part of Highway 415. At Chester, the L_{DN} would be about 40 dBA. These intruding noise levels are about the same or below the measured background L_{DN}'s. The potential impacts on communication interference and self-reported annoyance should be insignificant. Community response is likely to be sporadic complaints again, and probably based on subjective reasons.

Year 2028 mining operations would generally have insignificant annoyance impacts. The closest existing residences are about a mile away along Highway 9. They would have an estimated L_{DN} of about 44 dBA, which is well below the background and would cause no impact. At the Little Mountain Overlook, the projected L_{DN} is about 49 dBA, which would not cause communication interference. At the campground and ranger residence in the Jeff Busby developed area, it is estimated that the L_{DN}'s would be in the range of 39 to 44 dBA. These levels are below background L_{DN}'s and would not be expected to generate any type of response because of annoyance or disturbance of sleep in the campground.

Figure 4.19.1.2-4 Mining locations and projected noise emission levels.

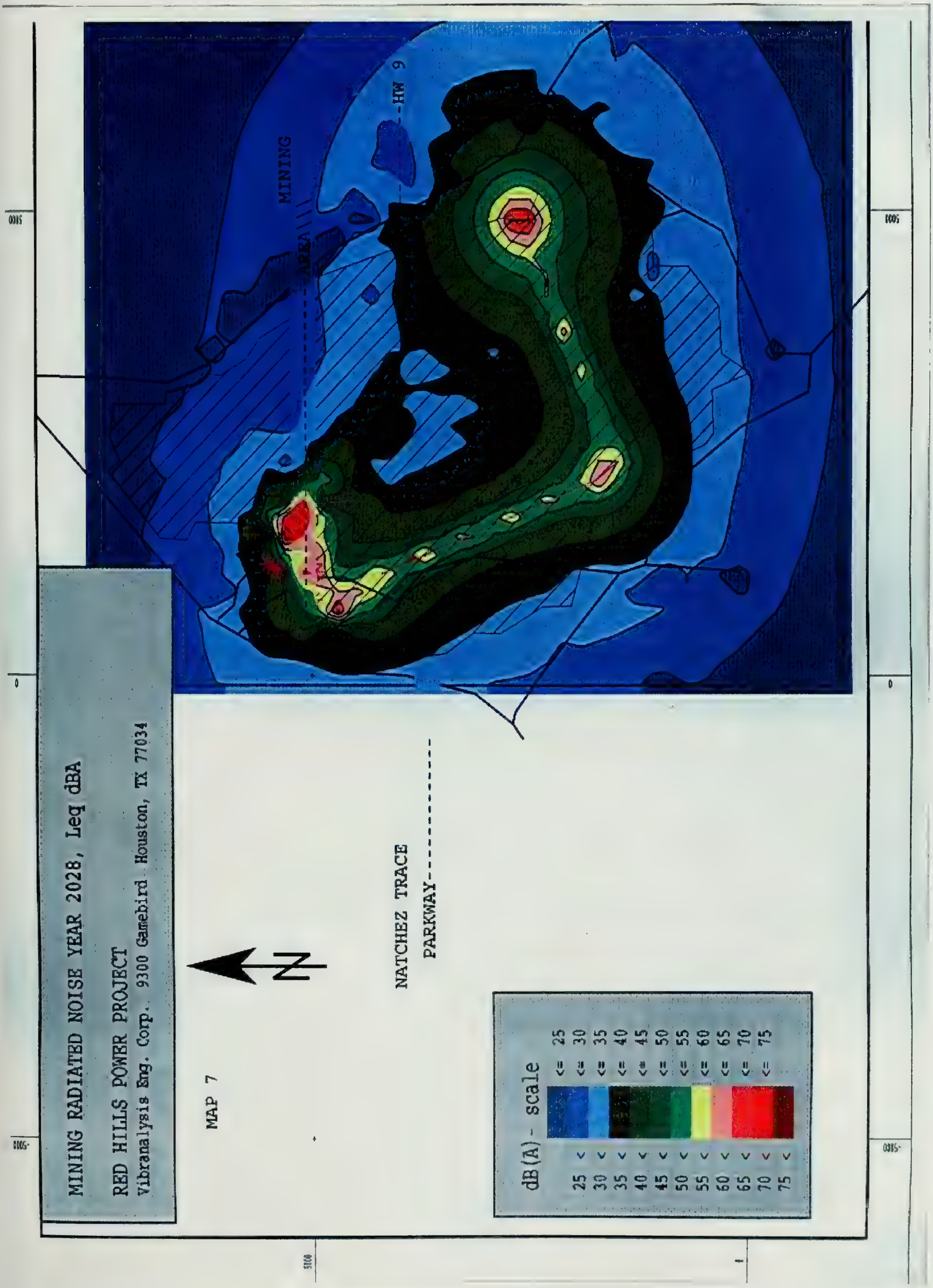
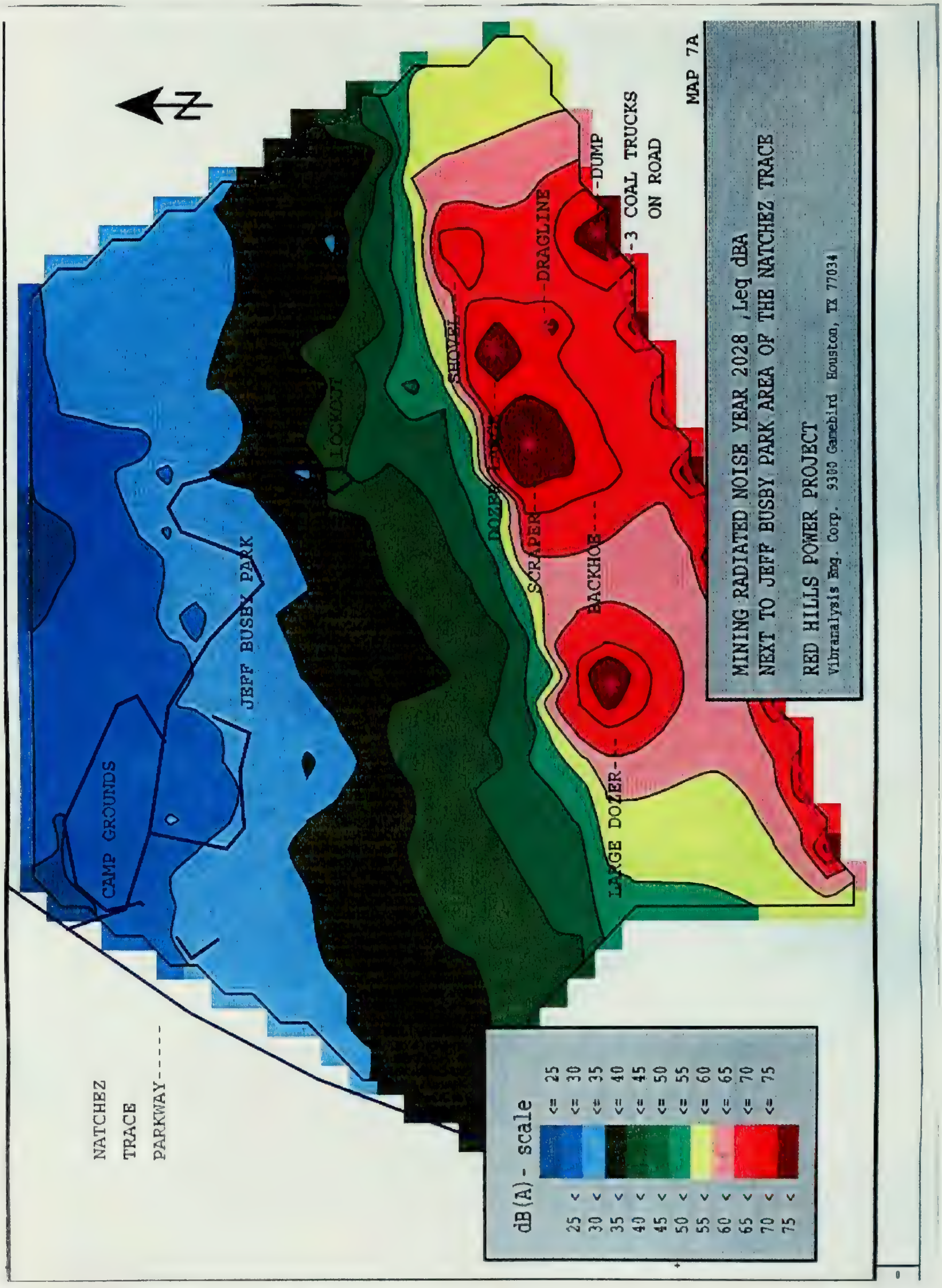


Figure 4.19.1.2-5 Noise modeling for Jeff Busby developed area and Little Mountain Overlook.



Transmission Line and Natural Gas Pipeline

There will be very insignificant impacts for operation and maintenance of the transmission line and natural gas pipeline.

4.19.1.3 Combined Impacts of Generation Facility and Mine

Construction

Hearing Loss – As with the individual construction sites, EPA's 70 dBA $L_{eq}(24)$ is the level of first interest. The addition of noise levels at a given location is found by summing the acoustic energy of the multiple sources and recalculating the $L_{eq}(24)$. The maximum increase in noise level from two sources occurs when the sources are the same. In this case the noise level increase is 3 dB. This means that 70 dBA $L_{eq}(24)$ can be reached by having two sources emitting 67 dBA $L_{eq}(24)$ to a given location.

Using the highest noise emissions of 89 dBA for excavation and finishing, construction phases 2 and 5, respectively, the calculated distance to 67 dBA is about 708 m (2,323 ft). The closest receptors to the generation facility and lignite mine are 1,100 and 750 m, respectively. Because these closest receptors are further than 708 m from any of the construction sites and they are not exposed to 67 dBA or higher there could not be any cumulative exposure reaching 70 dBA. There is no cumulative hearing loss impact from the RHPP construction.

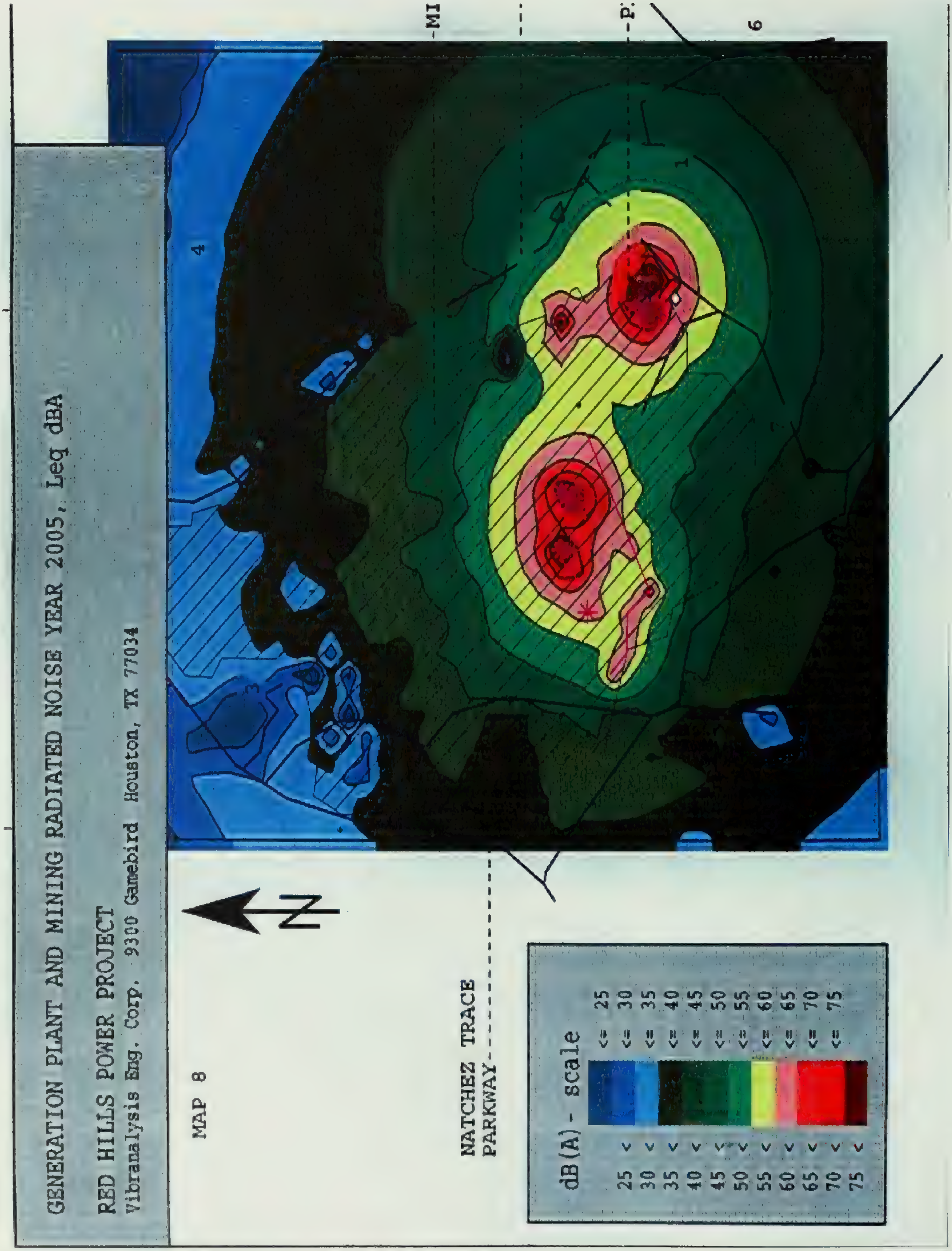
The noise emitted from the construction of the transmission line and pipeline will cause no impact on hearing loss either. These are short-term construction activities at any given location and might cause exposures for a few days at the longest. The 70 dBA level of concern is for a lifetime exposure.

Annoyance – Cumulative annoyance impact from the intruding noise levels should be insignificant for the construction of the RHPP. The closest mutual receptor for the generation facility and lignite mine is on Pensacola Road between the generation facility and Chester. It is about 1,600 m from the generation facility and lignite mine. The noisiest construction phases would emit about 44 dBA to the location from each construction site. The total would be about 47 dBA. The calculated intruding L_{DN} would be 45 dBA assuming daytime construction. This level is substantially below the measured background levels in the area.

Operations

Hearing Loss – As with the discussion of the cumulative hearing loss impact from construction, the cumulative exposure of 70 dBA is the level of concern. All cumulative exposures at neighboring receptors among the generation facility and lignite mine are less than this level. Figure 4.19.1.3-1 shows the modeled noise emissions from the operation of the generation facility and mine during year 2005. It shows no receptor areas having intruding noise levels near 70 dBA. There is no cumulative hearing loss impact from the simultaneous operations of these facilities.

Figure 4.19.1.3-1 Noise modeling for generation facility and mine, year 2005.



Annoyance – The closest mutual receptors for the operational noise emissions from the generation facility and lignite mine are along Pensacola Road leading into Chester. Figure 4.19.1.3-1 presents the modeled combined noise emissions map for operating year 2005. It shows this general areas having a combined intruding noise level in the 45 to 50 dBA range. A combined L_{DN} in the range of 51 to 56 dBA that is expected in this area would not cause significant communication interference although it would be noticed during outdoor activities. At this range it would be expected that some of the residents would report annoyance and there would be some sporadic complaints. The intruding L_{DN} is about the same level as the background L_{DN} of 56 dBA found in the Chester area. The modeling shows that the cumulative noise emissions of the generation facility and lignite mine would not be any worse than the individual emissions of each operation.

4.19.2 No Action Alternative

No noise impacts would be experienced if TVA does not buy the power. The population would remain about the same and the ambient noise levels would remain constant.

It is possible that another buyer for the electricity could be found. In this case, the construction and operations would proceed about as predicted in this analysis. The noise emissions, coverage areas, and impacts would be about the same as presented in this EIS.

There are other alternatives. These could include limited lignite mining and shipment to other locations or expansion of the EcoPlex with self-contained electric and steam production and sales of surplus electricity. In these situations the noise environment would change. Limited mining would produce noise emissions about the same magnitude as the mine operations described in Section 4.19. An expanded EcoPlex could cause noise emissions with a potential wide range.

4.20 Recreation

4.20.1 Action Alternative (Project as Proposed)

No general public recreation occurs on the proposed generation facility and mine sites because all of the property is privately owned. Therefore, there would be no loss of general public recreational opportunities on these sites due to the action alternative.

Hunting is a compatible use of mining lands except at active mining locations. All hunting clubs, with one exception, have leases outside the mining area. Additional nearby timber lands outside the mining area are available for leases.

Natchez Trace Parkway travelers not stopping at the Jeff Busby developed area would not be affected by mining operations. Those visiting the Jeff Busby developed area could be adversely affected by mining operations, if those operations are seen or heard by visitors utilizing Jeff Busby developed area facilities. The quality experience of viewing a mixed hardwood forest and hearing natural wildlife sounds could be replaced by mining operation sights and sounds.

4.20.1.1 Construction Impacts

There would be insignificant impact on general public recreation and hunting clubs within the project area from construction activities. Because the construction activities for the generation facility, mine, and transmission line and natural gas pipeline are similar, the impacts are discussed in Section 4.20.1.3, Combined Impacts.

4.20.1.2 Operational Impacts

<u>**Generation Facility**</u>

General public recreation on the proposed generation facility site would not be significantly impacted. Under certain weather conditions, as described in Section 4.2.1.2, the generation facility cooling tower and stack plumes could be visible to motorists on the Natchez Trace Parkway. Because of the distance from the generation facility to the Parkway (minimum of 3.5 miles) and vegetative screening along much of the Parkway, this would have little impact on Parkway motorists' recreational experience. Visibility of the generation facility plumes from the Little Mountain Overlook at the Jeff Busby developed area is described in Section 4.2.1.2; it would have minimal impacts on visitor's recreational experience. As described in Section 4.21.1.3, the generating facility itself would not be visible from the Parkway or Little Mountain Overlook.

Mine

In later years of the mining operation, Jeff Busby developed area and Little Mountain Overlook could be impacted by the sights and sounds of mining operations. However, sounds of mining equipment and trucks and lighting of the mine area are not expected to significantly alter the quality recreational visual, listening, and learning experience presently available, due to the planned mitigation measures outlined in the mine permit application, as discussed in detail in Section 4.21.1.3.

An opportunity exists to enhance fish and wildlife opportunities, because several of the sedimentation ponds could be left as permanent impoundments after mining, and made available for public use. Public recreation benefits would depend upon postmining ownership of the ponds, accessibility of the ponds to public roads, and the size and quality of the ponds.

Transmission Line and Natural Gas Pipeline

There would be no significant impacts from the operation and maintenance of the utility lines after construction is completed.

4.20.1.3 Combined Impacts of Generation Facility and Mine

General public recreation would not be significantly impacted within the project area. There are no hunting club leases within the proposed construction areas. Deer hunting would stop temporarily as mining operations approached the timberland leased by one small hunting club located near the northeast boundary of the mining operation. Additional traffic generated by temporary construction forces would create some congestion at roads intersecting the Natchez Trace Parkway during shift changes. Little Mountain Overlook visitors and campground occupants could notice mining sights and sounds, including nighttime illumination of the mine area, as the mine operations expand toward their direction in later years. There would be minimal impacts to general public recreation caused by the permanent employees at the generation facility and mine because existing public recreation facilities would absorb any increased use.

4.20.2 No Action Alternative

General public recreational opportunities would not change within the project area. It is unlikely that general public opportunities would become available, since the property would likely remain private.

Deer hunting would continue to be the primary recreational activity on private individually-owned property and on timber-company leased lands. Other hunting and fishing activities would continue at minor levels. Use of potential ponds for fishing and possibly waterfowl hunting would not occur if new ponds are not constructed as a result of the project.

The Natchez Trace Parkway and the Jeff Busby developed area would continue to function as it does today, with increased visitation likely in the future as population increases.

However, in the event the generation facility and mine were built and operated independent of TVA's involvement, impacts would be expected to be similar to those described in this EIS.

4.21 Visual Resources

4.21.1 Action Alternative (Project as Proposed)

The project area is a wooded rural countryside with occasional pasturelands, ponds, sparse residential development, and very few industrial features. The terrain is gently rolling with wide valleys, small streams, and dissected heavily-eroded uplands. Together, the natural and cultural elements form a generally harmonious mosaic of rural landscape. This section examines the visual consequences of building and operating a generation facility and mine along with the transmission line and the natural gas pipeline in the project area landscape. Figure 4.21.1-1 shows the location of the project features in relation to the Natchez Trace Parkway.

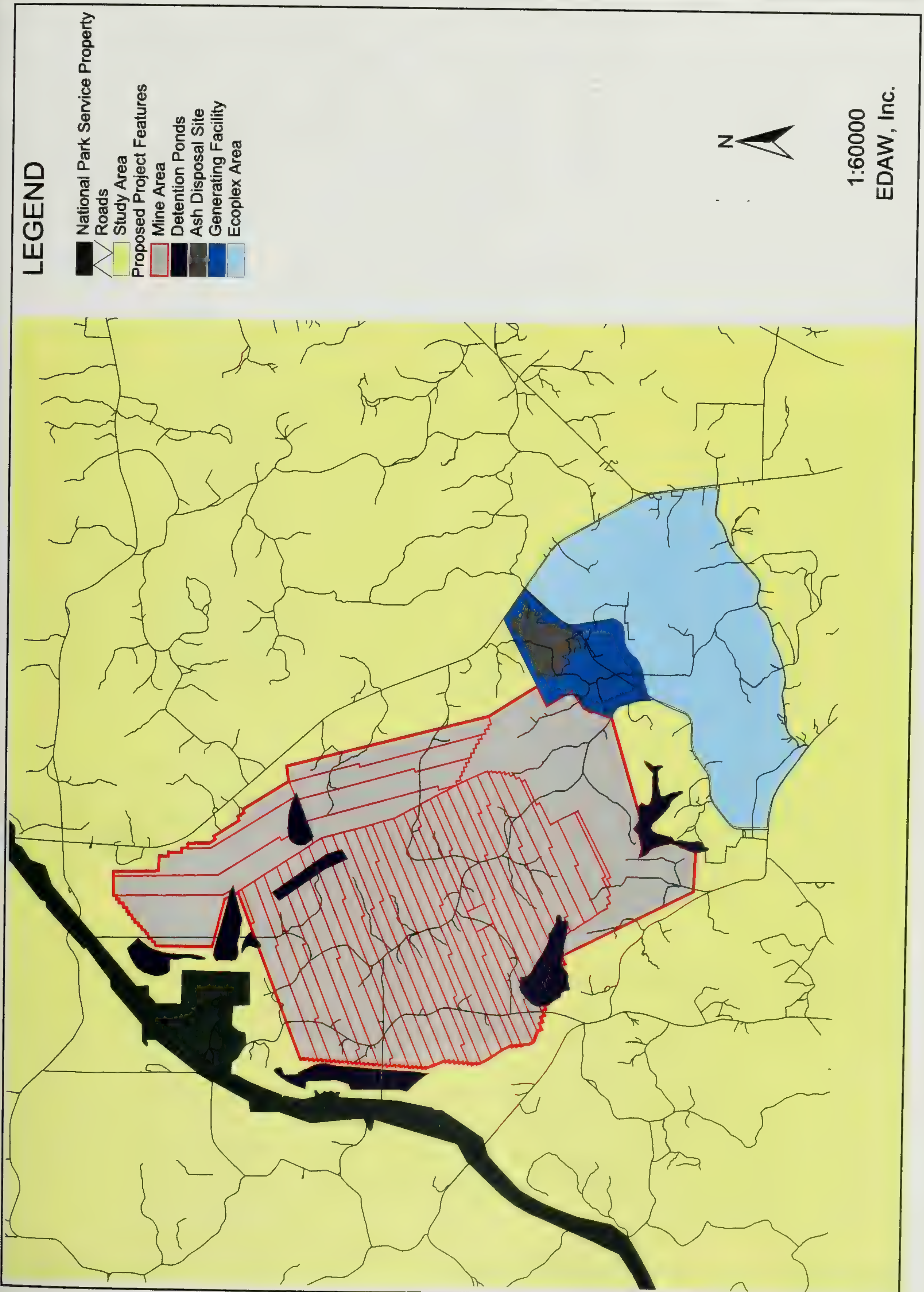
Visual consequences are examined in terms of foreground, middleground, and background distances, as previously defined in Section 3.21.1. In this assessment, the scenic attractiveness is described using the following adjectives: variety, unity, coherence, vividness, harmony, mystery, and uniqueness. Scenic Integrity indicates the degree of intactness or wholeness of the landscape character. These measures help identify important changes in landscape character based on commonly held perceptions of the beauty of landforms, vegetation patterns, composition, surface water characteristics, land use patterns, and cultural features.

4.21.1.1 Construction Impacts

Generation Facility

Facility construction would result in a conversion of land use from commercial forestry and residential to industrial (Figure 4.12.1-1 and Figure 4.21.1-1). The woodland continuity and visual landscape would be adversely impacted by large-scale earthwork, construction activities, and structures that are discordant with the character of rural countryside. These features would increase adverse variety, while reducing unity, coherence, and harmony. Scenic integrity would be lower.

Figure 4.21.1-1 Project features and the Natchez Trace Parkway.



Along Pensacola Road, residences that are located within the generation facility boundary would be removed. Motorists would see construction activities in the foreground as they look down the existing road and pass by on the relocated section. Approaching from the west, views along the tree-lined abandoned road section are relatively narrow. Views are somewhat broader when approaching from the east about 30 ft above facility elevation, and down a declining grade. The greatest negative impact would be along sections of the relocated road where most activities are visible to the north. Visible construction would include clearing and burning, grading cuts and fills with exposed soil up to 15 ft high, re-routed drainways, crushed stone parking areas and lay-down yards, temporary offices and warehouses, material stockpiles, fencing, and heavy equipment operations with related exhaust and dust. As the taller structures reach completion, they would be seen from further distances, such as open areas along Highways 9, 15, and 415.

The visual impacts of construction activity would be temporary, lasting about three years until clean-up and reclamation is complete. Adverse visual impacts could be reduced by screening construction views with densely planted evergreen trees on earth berms. The extent of reduction depends on location, size, and planting time.

Nighttime construction would also impact the surrounding rural landscape by increasing the night sky brightness several times over current levels, as discussed in the Night Sky section under Combined Impacts. The Chester community, as well as other farms, homes, and local traffic closer to the generation facility than Jeff Busby developed area (about four miles), would experience greater night sky brightness. Homes on Perry Road would see the greatest increase, and when leaves are gone they may also see construction lights on the structures. As they reach finished height, both structures and lights may be seen in the winter from one or more locations on Sanders and Pensacola Roads, as well as Highways 9 and 415.

Construction traffic would have an adverse impact on homes along Highway 9, Pensacola Road and other surrounding roads. The added trucks delivering materials and equipment, along with employee traffic of 750 up to 1,500 round trips per day at peak, would increase time that vehicles are a dominant element in the foreground of their landscape views. It would also impact local traffic on these roads by adding visual congestion.

Mine

Site preparation and initial mine construction would adversely impact the visual landscape character by removing forestry cover, altering surface water characteristics, modifying landforms, and introducing both structures and activities that could be considered discordant with the rural countryside. Timber would be harvested with the debris burned, two principal streams and their tributaries temporarily relocated, a water control lake and two sedimentation ponds built, the desirable selected overburden material stockpiled, and several eroded valleys filled about 60 ft deep with overburden to form a series of stair-stepped plateaus, which would create gentler slopes. The dragline would be erected, along with a powerline, transformer yard, temporary buildings, and long-term facilities. These features would

increase adverse contrast, while reducing unity, coherence, and harmony in the landscape during the initial construction period. Scenic integrity would be lower.

Visual impacts of most construction activities would be temporary. Adverse contrast would be reduced and visual harmony would improve within five years after reclamation is completed around ponds, along the stream relocations, and across the earth fill plateau areas. The completed long-term facilities would contribute to the visual impacts of mine operations.

Some of the construction impacts would be seen from public roads, but the majority of views would be limited to mine visitors, employees, and surface landowners. Existing roadside vegetation would occasionally impair the views. Traffic and homes on Highway 415 would have foreground views of valley fills A, B, possibly N, and two stockpiles east of N. Traffic and residents along Null and Salem-Bywy Roads would have foreground views of pond SP-2 and Little Bywy Creek diversion. Residents and traffic on the eastern end of Nebo Road could have middleground views of valley fills F, G, H, the initial lignite stockpile, and pond SP-2. Some residents in Chester may see water control lake construction about 400 ft north in pastureland. Visual impacts could be reduced by maintaining current vegetation, and enhancing with dense evergreens in the immediate foreground along roads and edges of construction areas.

Construction of the new 4-County powerline to the mine would have minimal temporary impacts. The line would be built in an existing ROW and incorporated on the same structures, so further clearing is unnecessary. Line construction materials, equipment, and activities would be seen by traffic and residences along Highway 9, from the Ackerman substation to the TVA transmission line. After the route turns and follows the TVA ROW west, only construction and occasional maintenance personnel would have a view.

Mine construction lighting would increase the night sky brightness somewhat over current levels, as discussed in the Night Sky section under Combined Impacts. The Chester community, as well as other farms, homes, and local traffic closer to the mine construction areas than Jeff Busby developed area (about 3.5 miles), would experience greater night sky brightness. Additional construction traffic would be minimal and have negligible visual impacts.

Transmission Line and Natural Gas Pipeline

Corridor A – Clearing the transmission line ROW would adversely impact the visual landscape by forming a contrasting vertical opening that reduces coherence and scenic integrity of the woodland. Visual impacts of material stockpiles, construction activities, equipment, and site reclamation along the route would be temporary and relatively minor.

Widening the ROW to parallel the existing line between the Sturgis and Ackerman substations would broaden the current opening and would have less adverse contrast than a new clearing. This section of ROW would be seen by motorists at the four road crossings and by churches near three crossings. The extent of visual impact to the churches depends on the final line location. Supplemental planting adjacent to the church property could help mitigate the impacts.

At Highway 15, the new line would cross along with several existing lines from the Ackerman substation, so the additional impact would be negligible. Visual impact of the new 4-County substation would be minimal if it is located east and out of view behind the current one. If located north or south of it, traffic would see both substations in the foreground, and clearing for it would increase adverse impacts. Vegetative screening on each side of the highway could help mitigate visual impacts of clearing and the new substation.

The final line location paralleling the railroad ROW would impact motorists and residents along Highway 15, and could impact those along Highway 9. They would see the corridor between patches of woods and across pastures in the middle foreground. The towers that are seen occasionally, as well as partial tower silhouettes above tree tops, would add elements of adverse variety and reduce coherence and harmony in the visual landscape. Motorists along the northern section of Sanders Road would have similar views of the towers across pastures. Where the line parallels Mabus Road and the southern part of Sanders Road, it would be screened by existing and emerging woodland.

Vegetative screens at highway crossings along the route would help mitigate and almost eliminate adverse views along, but outside the cleared ROW corridors, although this is rarely done except for high traffic urban or scenic areas. With landowner agreement, dense groups of preferably evergreen shrubs maturing at 15- to 20-ft high could be planted across the openings to fill the immediate foreground views. Effectiveness of this type of planting depends on height limits imposed by potential line sag and tower setbacks from the road, as well as location, size, and density. Planting shrubs promptly after clearing and careful location of access drives could also provide some screening of construction activities.

Corridor B – Clearing the ROW in this corridor would also impact the visual landscape by adding an adversely contrasting vertical opening. This would reduce unity, coherence, and scenic integrity of the woodland. The impact may be seen as more harsh because the ROW would be new. The temporary and relatively minor visual impacts of construction activities are similar to those for Corridor A noted above. This ROW would only be seen by motorists at three secondary road crossings and at the Highway 15 crossing. Vegetative screening recommended for Corridor A could also mitigate impacts along this route. From the highway to a junction with Corridor A near Mabus Road, the line would be screened by existing and emerging woodland.

Natural Gas Pipeline - Clearing additional ROW parallel to transmission line Corridor A for the underground natural gas pipeline would broaden the woodland opening somewhat, but the adverse impacts would be minor. The added visual impacts of trench excavation, soil piles, material stockpiles, construction activities, equipment, and site reclamation seen by motorists and residents along the route would be temporary, and relatively minor.

4.21.1.2 Operational Impacts

Generation Facility

The industrial structures and activities of the generation facility would adversely impact the visual landscape and forest continuity by introducing features which are not in scale or character with the rural

countryside. Plant structures include a 350-ft high stack, 185-ft high boiler/turbine building, 60-ft high cooling tower, along with a waste wood stockpile, storage structures, crusher buildings, conveyors, transformer yard, and other structures that vary in height up to 140 ft. When seen in the foreground and middleground, these features would increase adverse contrast and variety, while reducing unity, coherence, and harmony in the landscape. Scenic integrity would be low. A dense woodland buffer would surround the ash management unit screening it from most public views. Southbound traffic on Highway 9 may have a brief view across the TVA transmission line ROW, or through the woods when leaves are gone. Another ash management unit could be added in the future, which may increase visual impacts depending on the location and screening. Lighting for nighttime operations and aviation warning would have an impact on the night sky brightness, as discussed in the Night Sky section under Combined Impacts.

A weather balloon, raised to specific heights above the proposed generation facility, helped determine stack visibility from various locations (Appendix D-6). The stack, and likely some other structures, would be seen from one or more locations on Nebo, Pensacola, Sanders, and Perry Roads, as well as Highways 15, 9, and 415. When leaves are gone, these views may expand somewhat to see more of the structures, particularly along Perry and Sanders Roads. Views could also expand as a result of clear-cut timber harvesting in the surrounding area. These views would be reduced as young timber growth and other vegetation matures along the road edges and provides screening in the immediate foreground. Plumes from the stack and cooling tower would be seen from the same and possibly other locations. The shape, size, and duration of these plumes would vary with changes in season and atmospheric conditions, as previously described in the Visibility Section of Section 4.2.

Motorists southbound on Highway 9 just north of the TVA transmission line and looking southwest, would see the stack and generation facility structures in the near middleground across a maturing pine plantation. Figure 4.21.1.2-1 shows the simulated view from this location. As the pines continue to mature, less of the structures would be seen, and may be fully screened within ten years. If foreground vegetation is continually removed or the back-lying tract is clear-cut, then more of the generation facility would become visible. The stack, and possibly tops of other structures would also be seen briefly at the transmission line crossing. Motorists northbound on Highway 415 near the Lebanon Road intersection and looking northeast, would see the stack and plant structures about 2 miles in the distance across young clear-cut regrowth. Figure 4.21.1.2-2 shows the simulated view from this location. This view would be seen along a half-mile section of road. If roadside vegetation is allowed to grow, then this view may be screened within seven years, but more of the facility would be visible if it is removed. At each location, the plumes may remain visible above the vegetation after the structures are screened. If the vegetation is deciduous, the structures would likely be visible when leaves are gone.

Figure 4.21.1.2-1 Simulated view of the generation facility, facing southwest from Highway 9.

Figure 4.21.1.2-2 Simulated view of the facility, facing northeast from Highway 415.

Motorists along Pensacola Road would see various structures above tree lines as they look down the existing road sections. Approaching from the west, ground views down the abandoned road section are relatively narrow since trees line both sides. Views are somewhat broader when approaching from the east down a declining grade. The greatest impact would be along sections of the relocated road where the full plant is visible to the north. Motorists would see the transformer yard across the fenced detention pond and cooling tower on the eastern side of the immediate foreground, with the turbine building, stack, and other structures further back. Adverse visual impacts could be partially reduced by screening with earth berms and dense planting. The extent of reduction depends on location, size, and plant species.

The color of generation facility structures would affect the visual impact. Traffic on Pensacola Road would see the main structures against an evergreen woodland background or the sky above it. From most other locations, the structures would be seen against the sky; occasionally they would be seen through woods in the winter. A flat color in the medium cool-gray range could help minimize the impact, depending on the viewing direction, the sun's position, and background. This color range would somewhat reduce contrast with blue skies, and be compatible with both overcast gray skies and the gray tones of deciduous tree trunks.

The employee traffic increase is small and would have a negligible impact. Twice a year for two weeks, the employee traffic would increase by almost 200 round trips per day for outages which would increase the visual impact. The weekly limestone delivery traffic (at least 41 trucks per day during a single shift) would have an adverse impact on the views of motorists and residents along Highway 9, Pensacola Road, and other routes traveled. At a rate of four or more round trips per hour, these trucks would be a dominant element in the foreground of landscape views. The quantity of trucks would also impact local traffic by adding visual congestion. If ash is frequently trucked from the facility to an end-user, visual impacts from truck traffic would be greater.

Mine

Mining operations, progressing through a series of similar-sized land areas, would adversely impact the visual landscape character. The principal activities of fully clearing the land, altering surface water characteristics, progressively excavating an open trench mine, and operating large mining equipment are largely discordant with the rural woodland countryside.

The progressive operation would begin to reclaim a couple hundred acres per year of disturbed land. Activities include timber harvest, debris burning, structure and road removal, stream and tributary diversion, sedimentation pond and powerline construction, trench excavation, dragline and heavy equipment operation, trench backfill, finish earthwork, and revegetation. These features would add adverse contrast, while reducing unity, coherence, harmony, and visual tranquillity in the landscape. However, reclamation is contemporaneous with mining activities, so these adverse impacts at any given place in time would be short-term. Scenic integrity would be low.

The mine pit is typically a stair-stepped pit of bare soil and rock, about 1,000 ft wide, 200 ft deep, and 9,000 ft long with a sloped highwall along one side. Together, the excavation and spoil would present a harsh visual contrast to the surrounding wooded landscape, if no mitigation measures were taken.

The progressive restoration process follows mining operations on a 24-month cycle, from pit opening to completion of backfill and seeding, with tree planting beginning in the following one to two years. During periods of timber removal and postmining revegetation, the visual impacts are quite similar to harvest and planting cycles of commercial forests seen in the current landscape. Therefore, postmining revegetation would have less discord and adverse contrast, and would have greater coherence and scenic integrity than most post clear-cut areas.

During the operation period, some impacts of mine activities would be seen from perimeter and internal roads. However, most foreground views would be limited to a relatively small number of people including mine employees, visitors, surface landowners, and some local residents. Traffic and residents along various internal roads may see mine operations for several years, if road closings and relocations are not done too far in advance. When mining is viewed in the foreground, overburden spoil and the top 50 feet of dragline boom could be seen. On Tomnolan Road looking north, one ridgetop home has foreground to middleground views of pond SP-3 and mining during years 22 to 29. Looking east, the home has views of mining during years 9 to 18. Traffic and residents along the eastern side of Highway 9, north of Nebo Road intersection, have foreground views across pastures and through woodland strips to mining and the powerline in years 32 to 37. Views from the majority of other perimeter roads are screened by woodland buffers.

Nighttime mining operations would impact the surrounding area by increasing night sky brightness multiple times over current levels, as discussed in the Night Sky section under Combined Impacts. The level of added brightness would be greatest for residents and local traffic closest to the active trench, as mine operations move northward. Lights from mine activities and equipment could be seen from the locations noted above, and would be a visual distraction to motorists and residents. Impact of these lights may expand when leaves are gone.

Additional employee traffic (up to 131 daily round trips) would have minimal increased presence in foreground views along the roads, and would add slightly to visual congestion seen by local traffic.

There would be few, if any, long-term visual impacts from the mine operation. By the end of the mine reclamation period all mine-related structures and equipment would be removed and comprehensive revegetation activities would be complete. If landowner preferences shift forest restoration to primarily evergreens, there would be a loss of variety and seasonal vividness in the landscape. If preferred revegetation shifts from forests to more pasture, there would be an increase in variety with some loss of unity. Assuming the lake and possibly a few sedimentation ponds remain, they would add bodies of surface water not currently present. Homes may or may not be rebuilt in the area. Homes, water features, and more pastureland would increase compatible variety and harmony, while restoring visual coherence of the rural landscape. The reclamation plan would include planting a variety of mast- and

fruit-producing hardwoods for enhancement of fish and wildlife features. Therefore, the visual impact of the reclaimed mine area could be somewhat positive rather than negative.

Transmission Line and Natural Gas Pipeline

Views of the cleared ROW corridors at road crossings, towers, lines, and the new substation would impact the visual landscape by adding adverse variety and reducing unity, coherence, and harmony. ROW maintenance with herbicides would result in brown, dead vegetation seen for 6 to 9 months, adding to the visual impacts. The maintenance impact would occur on a repetitive cycle every several years. Existing and emerging woodland would screen the line where it parallels Mabus Road, Sanders Road, and the railroad, except for occasional views across open pastures. Towers would be seen occasionally, as would partial tower silhouettes above tree tops.

Vegetative screens at highway crossings along the route could help mitigate and almost eliminate adverse views along, but outside of the cleared ROW corridors, although this is rarely done except for high traffic urban or scenic areas. Maintenance activities could be performed in the corridors unseen behind the vegetative screens. With landowner agreement, dense groups of preferably evergreen shrubs maturing at 15 to 20 feet high, could be planted across the openings to fill the immediate foreground views. Effectiveness of this type planting depends on height limits imposed by potential line sag and tower setbacks from the road, as well as plant location, size, and density. Planting shrubs promptly after clearing and careful location of access drives could also provide some screening of construction activities.

Visual impacts of occasional signs and equipment related to the underground natural gas pipeline would be negligible.

4.21.1.3 Combined Impacts of Generation Facility and Mine

Construction Impacts

Night Sky – Night lighting for construction activities would increase the night sky brightness by a measurable amount (Clanton 1997). On an average, this would impact astronomical viewing of skies with little or no cloud cover, on about 200 nights per year. Rainwater Observatory and the campground at Jeff Busby developed area would be affected during the construction period, as would residents in surrounding areas.

Construction of mine facilities would take place predominantly during the day. The only night lighting needed for the mine during the construction phase would be security lighting. The estimated need for this security lighting is between 26,000 and 520,000 lumens for this security lighting. See Appendix D-7.

Generation facility construction would take place 24-hours per day for about 13 months of the construction period. Since generation facility construction lighting would be moveable, it would be more difficult to control. As portions of permanent lighting are installed, they would be used for construction

purposes. It is assumed that the amount of light needed for plant construction would be between 7 million and 10 million lumens.

Table 4.21.1.3-1 shows that the ranges of estimated brightness increase from shielded and unshielded light, based on the estimated range of construction lighting needs. Dark Sky (shielded) lighting is based on the guidelines in Appendix D-7. Walker's Law (International Dark-Sky Association, no date), which is a correlation developed to help estimate the increase in sky brightness at an observatory due to a nearby city, was used to develop the table. See Appendix D-7.

Table 4.21.1.3-1 Estimated Increases in Nighttime Sky Brightness During Construction

	Mine		Generation Facility	
As viewed from:	Typical Lighting (Unshielded)	Dark Sky Lighting (Shielded)	Typical Lighting (Unshielded)	Dark Sky Lighting (Shielded)
Rainwater Observatory	up to 1.01 times	Negligible	1.02 to 1.11 times	1.01 to 1.07 times
Jeff Busby developed area	up to 1.14 times	up to 1.09 times	1.40 to 2.93 times	1.26 to 2.25 times

The effects of increases in background sky brightness on the contrast and visibility of the Milky Way, Little Dipper, and other astronomical objects are discussed in Chapter 3, Section 21. The amount of increased brightness depends on the amount of light actually used at construction facilities.

If typical lighting were used for mine construction security, the brightness increase would have a small, but potentially noticeable, effect on activities at the observatory. The background brightness increase would be somewhat greater for the Jeff Busby developed area and nearby residences, but the Little Dipper and most of the Milky Way would remain visible. Mitigation with shielded lighting would minimize the brightness increase for the Jeff Busby developed area and local residents, and make it negligible at the observatory.

If typical lighting were used for generation facility construction, the background sky brightness increase would be noticeable at the observatory. Fewer astronomical objects would be visible through telescopes. The background sky would be brighter as viewed from Jeff Busby developed area and nearby residences, with the Milky Way visible most of the time and with the fainter stars of the Little Dipper visible some of the time or not at all. The process of mitigating the brightness increase would consist of several steps which include evaluating the need for various nighttime activities, determining the appropriate lighting level and frequency for these activities, then implementing appropriate "dark sky" lighting techniques. Mitigation with shielded lighting would minimize the sky brightness increase, reducing the effect on observatory users and allowing the Milky Way and the Little Dipper to be visible most of the time from Jeff Busby developed area. Mitigation with shielded and low-pressure sodium (LPS) lighting, used wherever color recognition and depth perception are not critical, would eliminate the impact from this type of light on the observatory. LPS light would be filtered out completely with telescope filters, but would still contribute to sky brightness seen with the naked eye.

On the generation facility stack, a nighttime aviation warning device that makes repetitive strobe flashes would significantly impact telescope use and photography at the observatory. To mitigate this impact, a dual lighting system in accordance with FAA Advisory Circular AC 70/7460-1J(1/1/96) would be used during stack construction. Using medium-intensity strobes during the day and only steady red lights at night would eliminate the impact telescope-aided viewing. In addition, minimizing installation of lighting fixtures and use of lights would further reduce potential impacts.

Occasional smoke from burning cleared noncommercial brush and tree stumps would impact the observatory to the extent it adds haze to a clear night sky. The impact could be greater if the wind is from the northeast, which occurs about 15% of the year in this area. Most debris would be buried, but burning is anticipated about 20 days a year and the process could continue after dark.

Natchez Trace Parkway – See Figure 4.21.1-1 for location of project features and the Parkway. There are no generation facility or mine start-up construction areas visible from the Parkway itself. The increased presence of construction employee traffic would adversely impact visiting motorists on the Parkway, by causing their visual attention to shift from the passing landscape to the volume and speed of vehicles present. Having to focus on commuting traffic with point to point urgency would also impact the visual satisfaction experienced by visitors with more casual purposes. As described in Section 4.16, MLMC and CGI would discourage their employees from commuting on the Parkway.

Nighttime generation facility construction would impact the Natchez Trace Parkway traffic in this rural landscape by increasing the night sky brightness, as discussed in the preceding Night Sky section. The increased brightness would also adversely impact camping and other nighttime experiences at Jeff Busby developed area, by reducing the darkness and visibility of stars associated with a night in the countryside.

Project construction areas are not visible from Little Mountain Overlook. Clearing and construction of the mine facilities, generation facility, and detention reservoir could be visible 3.5 miles in the background, if visitors wandered south beyond the parking area, through the woods, and past the NPS water tank. However, visitor access to this area is not authorized by NPS. Visibility from this point would depend on the height of clear-cut regrowth on adjacent MLMC property at viewing time.

Operational Impacts

Night Sky – Night lighting for generation facility and mine operations would increase the night sky brightness a significant and measurable amount (Clanton 1997). On an annual average, this would impact astronomical viewing of skies with little or no cloud cover, on about 200 nights. Rainwater Observatory and the campground at Jeff Busby developed area would be affected for the life of the project, as would residents in the surrounding area.

The generation facility and mine would both operate 24 hours per day. The amount of light needed for generation facility operation is estimated to be between 4 million and 14 million lumens (Appendix D-7). These levels were targeted for this project prior to lighting design, although normal plant lighting levels may be up to 25% higher. There is an estimated need for between 5 million and 14 million lumens for

mine operation. About 95% of the mine lighting would be moveable, which makes the light direction more difficult to control. This could have a greater incidental impact on the observatory and campground than the plant lighting.

Table 4.21.1.3-2 compares the range of estimated brightness increases from shielded and unshielded lighting, as determined from the range of light needs. Walker's Law (Appendix D-7), and estimates of operational lighting needs, were used to develop the table. Dark Sky (shielded) lighting is based on guidelines in Appendix D-7.

Table 4.21.1.3-2 Estimated Increases in Nighttime Sky Brightness During Operation

	Mine		Generation Facility	
As viewed from:	Typical Lighting (Unshielded)	"Dark Sky" Lighting (Shielded)	Typical Lighting (Unshielded)	"Dark Sky" Lighting (Shielded)
Rainwater Observatory	1.02 to 1.17 times	1.01 to 1.11 times	1.01 to 1.15 times	1.01 to 1.10 times
Jeff Busby developed area	2.6 to 16.04 times	2.04 to 10.78 times	1.24 to 3.69 times	1.15 to 2.75 times

The effects of increases in background sky brightness on the contrast and visibility of the Milky Way, Little Dipper, and other astronomical objects are discussed in Chapter 3, Section 21. The amount of increased brightness depends on the amount of light actually used at the facilities during operation.

If typical lighting were used for mine operations, the brightness increase would be noticeable at the observatory. Fewer astronomical objects would be visible through telescopes. The background sky would be significantly brighter for Jeff Busby developed area and nearby residences, with fainter stars of the Little Dipper never visible and the Milky Way rarely visible. As mine operations move closer to Jeff Busby developed area, the background sky brightness would increase and even fewer astronomical objects would be seen. Mitigation with shielded lighting would reduce the sky brightness, and improve the likelihood of seeing parts of the Milky Way and Little Dipper, but they would not be visible if the maximum of the range of predicted lumens were used. Mitigation with shielded LPS lighting, used wherever color recognition and depth perception were not critical, would eliminate the impact of this type of light on the observatory. LPS light would be filtered out completely with telescope filters, but would still contribute to sky brightness seen with the naked eye.

If typical lighting were used for generation facility operations, the brightness increase would be noticeable at the observatory, with impacts similar to those described above. As with construction, the process of mitigating the brightness increase would consist of several steps. These include evaluating the need for various nighttime activities, determining the appropriate lighting level and frequency for these activities, then implementing appropriate "dark sky" lighting techniques. Mitigation with shielded LPS lighting would provide benefits similar to those described above for telescope users at the observatory. The impact would be brighter for Jeff Busby developed area and nearby residences, with parts of the Milky Way visible but parts of the Little Dipper only visible occasionally. Mitigation with shielded

lighting would reduce the brightness increase for the Jeff Busby developed area and local residents, allowing fainter stars of the Little Dipper to be visible most times.

For the generation facility stack, the dual lighting system of aviation warning devices initiated during construction would continue in use during operations. Using medium-intensity strobes during the day and only steady red lights at night would eliminate the night flash impact on telescope-aided viewing.

Airborne dust and smoke would have a negative effect on the observatory, to the extent it adds haze to a clear night sky. The impact can be greater if the wind is from the northeast, which occurs about 15% of the year in this area.

Combined lighting impacts are shown in the Night Sky section of Cumulative Impacts.

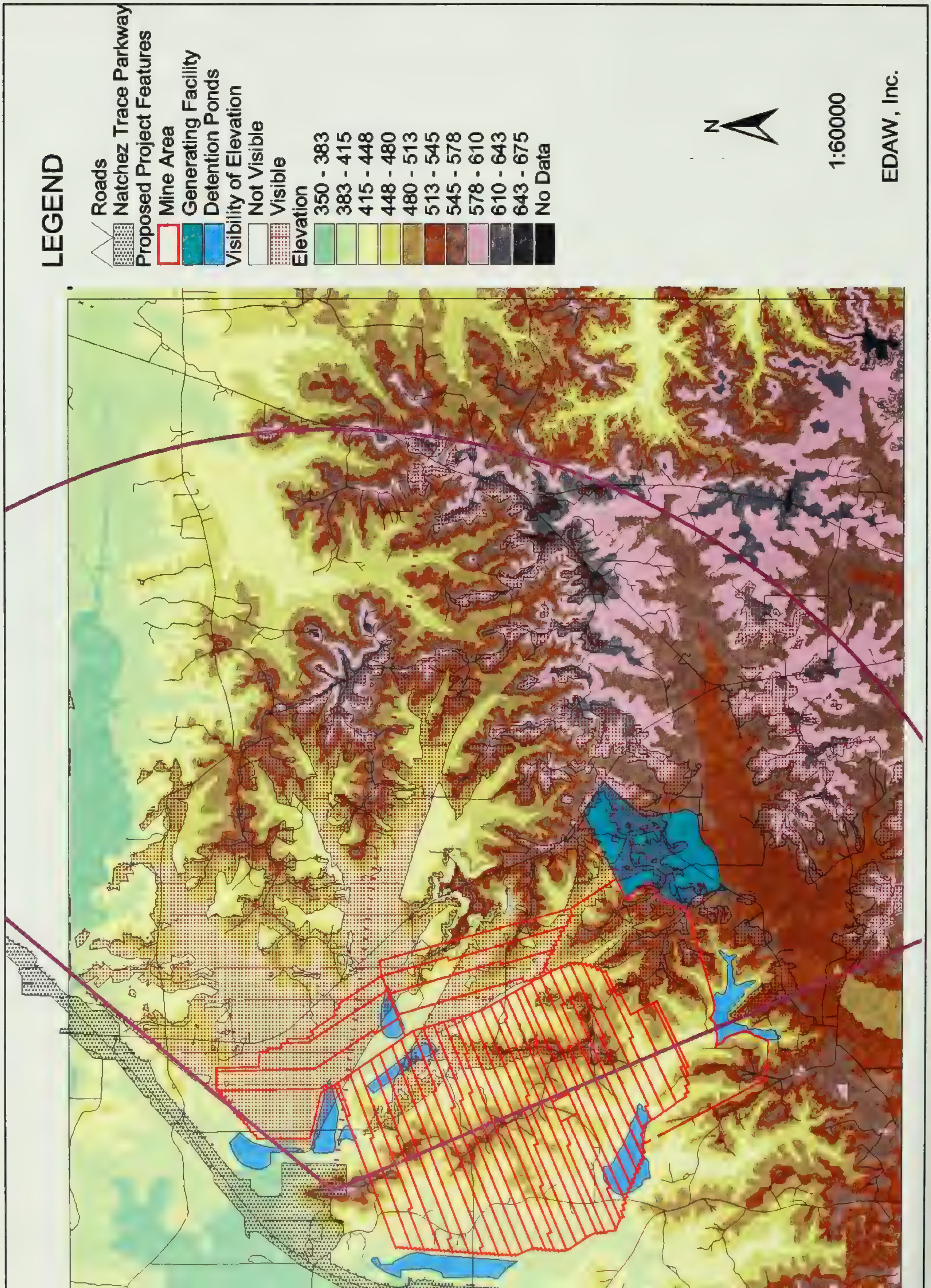
Natchez Trace Parkway – Generation facility operations are not visible from the Parkway. Beginning in the sixth operational year, occasional views of mine operations may be seen from portions of the Parkway whenever deciduous leaves are gone. Scenic integrity and harmony would be reduced. Starting about 0.7-mile south of Jeff Busby developed area entrance, brief views could be available through the mature woods buffer 300 to 400 ft wide, for the next mile south. Views could include pond SP-3 at least 500 ft from the Parkway, and mine operations about 2,000 ft beyond, during years 20 to 29. Beginning in the 30th year, similar brief views of pond SP-5 may be seen along a 0.5-mile section, starting 0.8 mile north of Jeff Busby developed area. Lights from mine activities and equipment moving beyond the trees and across the ponds could be seen by visiting motorists along these same areas of rural woodland. Since additional woodland buffers 2,000 feet wide would be provided through land use agreements, the mine and ground-level lights might not be seen from the Natchez Trace Parkway.

Nighttime mine and plant operations would impact motorist's views of the overhead sky by increasing night sky brightness several times over current levels, as discussed in the Night Sky section. The increased brightness could also impact camping and other nighttime experiences at Jeff Busby developed area, by reducing the darkness and clear visibility of stars associated with a night in the countryside. The greatest brightness increase would occur in mining years 28 to 33 when mining would be closest to the Parkway.

On Little Mountain Overlook, the western facing overlook is not impacted by the generation facility or mine, and could continue to serve as the viewpoint for undisturbed distant views. It is assumed that the NPS has no current plans to remove any foreground vegetation from the eastern facing overlook. However, a visibility analysis was performed for the eastern facing overlook viewpoint with the vegetation removed, which is the worst case situation. Figure 4.21.1.3-1 shows that if foreground vegetation was absent, the mining operation would be visible from the eastern facing overlook in most years. See Appendix D-7 for a summary of the viewpoint analysis and photo simulation process. The foreground vegetation is on NPS property which surrounds the overlook with a buffer several hundred feet wide and expanding to about 1,200 ft wide on the eastern side. Management of this foreground vegetation on the eastern and southern side is essential to minize visual impacts of the mining operation. If this foreground vegetation remains in place, and with the mitigation measures described below, the

project would not change landscape characters visible from NPS property and so would not impact the Parkway's intended design consistent with a traditional rural southern landscape objective and the management of most of its lands for natural ecological processes.

Figure 4.21.1.3-1 Visible areas, facing east from Little Mountain Overlook.



MLMC would continue to work with the NPS to mitigate any adverse measures to the Natchez Trace Parkway and its associated areas. These areas are outside of the mine area, and therefore, no disturbance would occur to either place. However, due to the proximity of these areas to the project area, MLMC has corresponded with the National Park Service to provide additional measures developed to prevent any adverse indirect impacts to the Parkway. The following plan summarizes these measures.

- Operations would be set back from the Parkway and the Little Mountain Overlook to provide a vegetational screening buffer. No lignite removal would be planned within 2,000 feet of the centerline of the Parkway, or within 1,000 feet of the property line around the Little Mountain Overlook. A sedimentation pond would be located within the buffer area, but would still be several hundred feet back from the Parkway, and thus, would not create a visual distraction through the trees. This setback would result in a loss of lignite resources available for recovery. Several million tons would otherwise be recovered if the buffer were not in place. This would also result in a loss of several hundred thousand dollars in mineral royalties to private landowners that own lignite and land along the Parkway.

- To further reduce visual impacts, the dragline would be located near the bottom of the active pit, so that only the top 50 feet or so would be above original grade. This should not be visible to Parkway visitors.

- The Little Mountain Overlook currently has viewsheds to the east and west. Tall trees and brush, along a ridge going southeast through the entire mine, block the view to the south. Therefore, mining operations would not be visible from the overlook until late in the life-of-mine. Mining is planned to continue east around the overlook in about 2027, when it then would be visible from the hill.

- Water from the mining area would drain under the Parkway. An analysis of hydrologic impacts has been conducted as part of the mine permit application. Through a comprehensive water management program, offsite impacts would be minimized. Runoff from mining operations would pass through sedimentation ponds and meet strict state effluent limitations for sediment load, pH, iron, and manganese prior to leaving the permit area. Controlled pond discharges could actually decrease downstream erosion potentials. There should be no perceptible difference in water quantity or quality running under the Parkway.

- Fugitive dust emissions from the mine would be controlled. The mine would follow an air pollution control plan required as part of the mine permit application. Two 12,000-gallon water trucks would be purchased for haul road and work area watering to minimize dust.

- The MLMC would have an environmental training program. Sensitivity training would be provided to employees emphasizing the nearby Parkway, encouraging all employees to be proactive in their own individual work areas to minimize impacts. This would include discouraging commuting on the Parkway, proper water management, respect of setback areas, picking up litter, taking proper care of equipment to reduce equipment noise and emissions, and operating in a manner that reduces noise, dust, and other impacts.

4.21.2 No Action Alternative

Without the generation facility and mine development, there would be no construction or operational consequences to impact the visual landscape character. However, clear-cutting activities associated with on-going commercial forest operations would continue to have significant negative visual impacts on the area landscape.

In the event the generation facility and mine were built and operated independent of TVA's involvement, visual impacts would be expected to be similar to those described in this EIS.

4.22 Cumulative Impacts

4.22.1 Introduction

The preceding portions of this chapter describe the direct and indirect impacts of both the action alternative, which would result in the construction and operation of the Red Hills Power Project, and the No-Action Alternative. This section describes the cumulative impacts that could be associated with other past, present, and proposed actions. Cumulative impacts are the impacts on the environment that would result from the incremental impact of the alternative action when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes the actions. Cumulative impacts can result from numerous actions which, by themselves, may result in minor impacts but, over time, collectively have significant impacts.

The only proposed activity in the area that is likely to have potentially important impacts on resources common to these that would be impacted by the RHPP is the planned development of the EcoPlex industrial park, described in Section 2.5. Anticipated industries for the first phase of development include three greenhouse operations, three aquaculture operations, and a kenaf pulp mill. These industries would occupy up to 500 acres. When fully developed, EcoPlex tenants would occupy about 1,000 acres.

4.22.2 Air Resources

Criteria Pollutants

The cumulative impact of the proposed RHPP and proposed EcoPlex industrial park on ambient air quality standards was assessed by combining the PSD modeling results with PSD monitoring observations. EcoPlex emissions were estimated using the mix of tenant industries and employment levels described in Sections 4.22.1 and 2.5, and typical emissions of these similar industries elsewhere in the country. Heat and steam were assumed to be supplied by the RHGF. The main source of emissions from the kenaf mill are from the thermal oxidizer, kenaf raw material receiving and preparation, and particle board cutting and trimming. There are no significant sources of emissions from the greenhouse operations or from the aquaculture operations.

The maximum modeled concentration for each pollutant was added to the maximum observed concentration measured from November 1, 1996, through October 31, 1997, at the RHPP PSD monitoring station. The RHPP monitoring station was located about 1.5 km east of the proposed generating facility site. The potential impacts estimated by this assessment method are inherently conservative in that worst-case monitoring and modeling conditions are assumed to coincide in time and space (Table 4.22.2-1). As discussed below, this assessment serves more to bound the upper end of potential impacts than to provide a realistic estimate of typical cumulative impacts. To the extent that the RHPP contributes additional air pollution to the region, a decline in air quality and air quality related values would be anticipated. Relevant air quality standards are listed in Table 4.2.1-1.

Sulfur Dioxide - Primary SO_2 emissions from the RHPP, combined with anticipated emissions from the EcoPlex, would not result in a violation of the current annual, 24-hour, or 3-hour SO_2 national ambient air quality standards. Measurements from the monitoring station indicate that SO_2 levels are about 6% and 3% of the 24-hour and 3-hour ambient standard levels, respectively. Emissions of SO_2 from the RHPP would have potential environmental impact on SO_2 ambient air quality and secondary pollution concerns related to SO_2 emissions including particulate matter less than 2.5 microns ($PM_{2.5}$), acidic deposition, and regional haze.

Nitrogen Oxides - Primary NOx emissions from the RHPP, combined with anticipated emissions from the EcoPlex, would not result in a violation of the annual NO_2 national ambient air quality standard. Measurements from the monitoring station indicate that background NO_2 levels are only about 8% of the ambient standard. Emissions of NOx from the RHPP would have an impact on secondary pollutant issues including O_3, $PM_{2.5}$, plume blight, regional haze, and acidic deposition.

Ozone - Ozone concentrations in the area surrounding the generation facility are relatively low, with measured summertime maximum 1- and 8-hour concentrations falling between 80 to 90 and 70 to 80 ppb, respectively. These data fall within 89% of the new ozone standard. NOx emissions from the generation facility and EcoPlex would result in formation of additional O_3 which would increase these concentrations.

Carbon Monoxide - Primary CO emissions from the RHPP, combined with anticipated emissions from the EcoPlex, would not result in a violation of either the 8-hour or 1-hour CO national ambient air quality standards. Measurements from the monitoring station indicate that maximum background CO levels are about 5% and 14% of the 1-hour and 8-hour ambient standard levels, respectively.

Particulate Matter - PM_{10} emissions from the RHPP, combined with anticipated emissions from the EcoPlex, would not result in a violation of either the annual or 24-hour PM_{10} national ambient air quality standards. Measurements from the monitoring station indicate that maximum background PM_{10} levels are about 49% and 36% of the 24-hour and annual ambient standard levels, respectively.

Lead - Primary lead (Pb) emissions from the RHPP, combined with anticipated emissions from the EcoPlex, would not result in a violation of the quarterly national ambient air quality standard.

Measurements from the PSD station indicate that maximum background lead levels are about 2% of the ambient standard.

Table 4.22.2-1 presents the worst-case measured and worst-case modeled impacts; the sum of these two values is then compared to the ambient standard. These measured and modeled concentrations do not coincide in space or time; therefore, the results should not be interpreted to mean that actual impacts would exceed any standard.

Table 4.22.2-1 Cumulative Impacts ($\mu g/m^3$) on Ambient Air Quality

Pollutant	Avg. Period	Observed Maximum	Modeled Maximum	Sum	Standard [a]	% of Std.
SO_2	Annual	5.2	8.7	13.9	80.0	17.4
	24-Hour	20.9	116.9	137.8	365.0	37.8
	3-Hour	44.5	264.8	309.3	1,300.0	23.8
NO_2	Annual	7.5	6.6	14.1	100.0	14.1
PM_{10}	Annual	21.7	19.4	41.1	50.0	82.2
	24-Hour	73	58.0[d]	131.0	150.0	87.3
$PM_{2.5}$	Annual	-	-	-	15	-
	24-Hour	-	-	-	65	-
CO	8-Hour	1,483.5	141.9	1,625.4	10,000.0	16.2
	1-Hour	2,047.8	1064.1	3,111.9	40,000.0	7.8
Ozone[b]	8-Hour	153.1	29.5[c]	182.6	157.0	116.3
Lead	Quarter	0.028	-	-	1.50	-

[a] National ambient air quality standard.

[b] Ozone is a secondary air pollutant, an appropriate modeled increment cannot be determined. See above discussion.

[c] Modeled maximum O_3 increase due to RHGF NOx emissions.

[d] Modeled sixth highest concentration over 5 years.

Air Quality Related Values

The Clean Air Act (CAA), as implemented by the Prevention of Significant Deterioration (PSD) regulations, (40 CFR 52.21) provides special protection for air quality and air quality related values (AQRVs) in certain national parks and wilderness areas, designated as Class I areas. Air pollution effects have been interpreted to constitute an adverse impact in Class I areas if they meet any of the following criteria (Federal Register Vol. 47 p. 30223, July 12, 1982).

- Diminish the national significance of the area,
- Impair the quality of the visitor experience, and
- Impair the structure and function of the ecosystem.

There are no Class I areas within 100 km of the RHPP site, but the Sipsey National Wilderness Area is within 200 km.

Federal Land Managers (FLMs) have the authority to review state permit requests for new or expanding sources whose air emissions might impact air quality and AQRVs in a Class I area. These AQRVs may include, but are not limited to, visibility, flora, fauna, surface waters, ecosystems, and geological, cultural, and historical resources. The CAA also requires reasonable progress towards a defined national goal of preventing visibility impairment by anthropogenic air pollutants (CAA, Section 169A). If FLMs determine that emissions from a proposed source might cause an adverse impact to AQRVs, they can recommend that the state deny or require modification to the permit application to further restrict emissions or offset impacts. The burden of proof to demonstrate these source-specific impacts falls on the FLM. The RHPP and EcoPlex would emit regulatory significant quantities of one or more pollutants which have been implicated in impacting AQRVs including visibility, soil and stream acidification, and vegetation injury.

Global Climate

Due to the magnitude of the CO_2 emissions from lignite combustion compared to all of the other emissions sources of greenhouse gases, including the EcoPlex, the generation facility was considered to be the prime source of potential impact. Table 4.22.2-2 indicates under the worst case scenario 5.30 million short tons of CO_2 would be emitted annually from RHGF. This case assumes worst case lignite heat content of 4,780 Btu per pound and maximum operation at 8,760 hours per year. What might be considered average operational conditions for RHGF would emit 3.45 million short tons of CO_2. In this case, the lignite heat content is assumed to be 5,485 Btu per pound and wood and or wood waste is co-fired on a 5% energy-input basis. Using wood as a fuel would displace or mitigate fossil-fuel CO_2 emissions by 219,000 tpy since burning a biomass fuel is considered a CO_2 neutral fuel source. The construction of RHGF would also result in lowering CO_2 emissions through the improved efficiency of electricity delivery to end-use customers. It is estimated that on an annual basis about 10 MW of electricity will be saved by avoiding line losses associated with wheeling power through the existing distribution lines. This 10 MW of power is calculated to result in lowering CO_2 emissions by almost 90,000 tons of CO_2 per year. The consequence of these emissions in terms of total US emissions for 1996 is insubstantial. RHGF CO_2 emissions are slightly more than 0.18% of the total CO_2 emissions from electricity generation in the US as a whole, or about 0.20% based on electricity generation from coal, which is the predominant fuel source (DOE/EIA 1997).

Table 4.22.2-2 Combustion Sources of CO_2 for RHGF

Worst Case			
Lignite Burned	Wood Burned	CO_2 (lbs/ton)	CO_2 Emission
$4.54 * 10^6$ tpy	none	2,340	$5.30 * 10^6$ tpy
Typical Case			
Lignite Burned	Wood Burned	CO_2 (lbs/ton)	CO_2 Emission
$2.95 * 10^6$ tpy	none	2,340	$3.45 * 10^6$ tpy
	243,000	1,800	219,000 tpy

In addition to the direct emission sources from the RHGF operation and the EcoPlex, there would be impacts on vegetation which would have consequences in terms of CO_2 emissions. Approximately

390 acres would be used for the generation facility construction and about 5,800 acres for the mine site. When in full operation, the EcoPlex is estimated to occupy about 1,000 acres. Aside from direct emissions from these facilities, the loss of vegetation due to building these facilities would mean that the vegetation removed would no longer be able to serve as a carbon sink for atmospheric CO_2. The magnitude of these emissions is very small compared to the annual emissions from the generation facility.

The lands affected by the siting of these facilities are predominantly forested (about 75%) and, therefore, if not used for construction of these facilities, would more than likely be managed for timber production. The rotation lengths used for timber production on these sites (>40 years) would result in little contribution to CO_2 storage space, as photosynthesis would be roughly balanced by respiration (Vitousek 1991). Mined land, which would be reclaimed and planted to trees, would influence the short-term storage of C, and in fact may initially increase the rate of C storage due to greater growth rates. The greater growth rates, after mining, are assumed to result from soil improvements due to physical and chemical alteration of postmining areas, and from use of improved pine varieties. However, while the C storage short-term rate (< 20 years) may increase for the mined areas replanted to trees, the magnitude of C storage would be insignificant compared to the CO_2 emission of the generation facility. Assuming a storage rate of 6 tons/ha/year (Sedjo 1989), this would be equivalent to a total of 55,000 tons CO_2 over 20 years or 2,750 ton CO_2 per year; this is less than 0.01% of the annual generation facility emissions. The magnitude of these emissions would not have a perceivable impact on global climate change.

Vegetation Impacts

Potential studies have investigated the impacts of air pollutants on individual plant species over the past 30 years. More recently, models have been developed to incorporate plant community or ecosystem responses to air pollutant exposure. Investigations have consisted of examining either acute exposure of pollutants, defined as short-term high levels of exposure lasting from hours to weeks, or chronic exposure, lasting for months to several growing seasons at pollutant levels at or above typical ambient concentrations. As might be expected, a myriad of results have been observed for a vast variety of crop and forest species. Due to the complexity of the subject matter and the magnitude of possible confounding factors that can influence response, i.e., plant cultivar, meteorological conditions, drought, exposure dosage, pollutant dosage dynamics, there is substantial uncertainty and speculation in evaluating vegetation types at risk from air pollution.

An acute dose of a pollutant is typically only great enough to illicit a detrimental vegetation response, i.e. leaf necrosis, morbidity, mortality, in the immediate vicinity of a point source. In this instance, RHPP would be considered a point source. Modeling results (Table 4.22.2-1) indicate that predicted maximum concentration within the "receptor modeled range" have virtually no possibility of causing acute impacts on vegetation, considering SO_2 and NOx modeled hourly concentration (Table 4.22.2-1) values and one-hour and eight-hour SO_2 and NOx threshold concentrations reported by Smith (1981) to cause acute plant injury symptoms. Predicted concentrations are from five-fold to over thirty-fold lower than generally required to cause injury. Inasmuch as SO_2 and NOx maximum concentrations are low and are well below (less than one-third of) the NAAQS (see Table 4.22.2-1), the likelihood of chronic impacts of these

pollutants on vegetation is remote. The NAPAP Report to Congress indicates that neither SO_2 nor NOx is a direct source of regional-scale growth or yield reduction to agricultural crops or forests in the US (NAPAP 1990).

The other criteria pollutants that would be emitted by the RHPP (PM, lead, and CO) are not expected to impact vegetation growth and vigor. Ambient air quality concentrations, predicted from modeling runs, show concentrations below NAAQS limits. Particulate matter impacts on vegetation have traditionally not been considered to be a significant factor in vegetation health.

The fact that the RHPP and EcoPlex will increase atmospheric concentrations of NOx means an increased likelihood of regional ozone formation. Modeling results indicate that on any given day there may be a 2 to 6 ppb additional ozone increment added to existing ambient ozone concentration. While this ozone increment could result in an 8-hour average number close to the new ozone standard, the influence of such an occurrence on vegetation health is not predictable. Considering that it is a well-established fact that the same ozone dose may illicit a different response for highly controlled research experiments from one year to the next, it is not possible to predict what this may mean for plant communities on a regional basis.

Acidic Deposition

“Acid deposition,” “acidic precipitation,” or, most commonly, “acid rain,” are all terms used to collectively describe the atmospheric transport and deposition of acidic substances. Man-made emissions of acid-forming gases, including SO_2 and NOx, increase the acidity of wet (rain, fog, snow, cloud water) and dry (fine particulates) deposition which may cause significant ecological damage to susceptible terrestrial and aquatic ecosystems. This deposition also contributes to enhanced weathering of paint, limestone, and metals including culturally important resources such as historic buildings, monuments, and tombstones. The National Acid Precipitation Assessment Program (NAPAP) indicates that in the United States only high-elevation soils and aquatic systems at high-elevation sites in the Southeast are at risk from damage to acidic precipitation (Irving 1991). Sulfate deposition is greatest at the higher elevations of the Southern Appalachians. Modeled mean wet sulfate loading range from 20 to 30+ kilograms/ha/year (SAMAB 1996). Portions of streams at high elevations are probably least able to neutralize or "buffer" incoming acidity.

In the absence of man-made pollution, natural rain is slightly acidic. This natural acidity is caused by carbon dioxide (CO_2) and naturally emitted acid gases. For temperate, mid-continental areas like the Tennessee Valley, this would translate to a pH of 5.2 (lower pH measurements indicate higher acidity). Man-made emissions from fossil-fuel combustion contribute to excess acidity. Long-term regional rain observations are four to eight times more acidic (pH of 4.3 to 4.6) than natural rain (NADP/NTN 1996).

The primary acidifying compounds in rainfall are sulfates and nitrates. The sulfur in acidic deposition is not thought to have adverse impacts on vegetation and may actually have slight positive benefits as a nutrient for soils low in native sulfur. For crops and forests growing on nitrogen-deficient soils, nitrate in deposition has positive benefits. However, some of the highest deposition loadings of sulfur, nitrogen,

and acidity in the US have been measured in the high elevations in the Southeast. The major concern relative to acidic deposition inputs to soils is the potential effect on the Ca:Al ratio in soil solution. Atmospheric deposition can increase the concentration of Al in soil solution (Al can be phototoxic to plants) and decrease base cations, especially Ca and Mg (Reuss 1983). However, there is little evidence to suggest that this situation exists, other than high elevation soils that receive high inputs of atmospheric S and N. In such sites, as represented by the proposed generation facility, which have highly weathered soils, predominated by pines and upland hardwoods, there is little data to suggest that acidic deposition will have detrimental effects. Loblolly pine, sites in the Southeastern US typically have no more than 5% of the established toxicity levels for Al, suggesting that the possibility for Al toxicity is remote. For hardwood tree species visible evidence for cation nutrient deficiency, such as Ca or Mg, are very rare, but there is some evidence of depletion of base cations in eastern hardwoods (Johnson and Todd 1987). These data suggest that changes may be a result of leaching and this may be linked to increased leaching due to acidic deposition inputs. But these data also demonstrate that customary practices, such as whole tree logging, may remove a significantly greater part of the pool reserves than base cation leaching through soil processes.

Since the late 1970s, SO_2 emissions have significantly declined across the eastern US and Canada in order to meet ambient SO_2 standards and to control acidic deposition (CAA, Title IV, 40 CFR Part 72-75). Recent assessments of long-term trends in rainfall chemistry have documented a corresponding significant decline in precipitation sulfate, a slight, less significant decline (increased pH) in rainfall acidity, and a slight increase in precipitation nitrate (NADP/NTN 1996). It appears that an overall increase in NOx emissions, and NOx-related acidity, during the same time has partially offset the improvements from SO_2 emissions reductions. A further decrease in acid deposition is expected as the Title IV program of the 1990 CAA Amendments is fully implemented. Vehicle emissions, a second major source of nitrogen compounds, are expected to grow in importance as the population of the region increases.

The recent NAPAP interim report to Congress (Uhart et al. in press) indicates that over the past 20 years (1975 through 1995) SO_2 emissions have declined roughly 40% nationwide. The report states that along with emission reductions there is also a trend in reduced regional precipitation sulfate in the Southeast. The report further states that while improvements in precipitation sulfate concentrations have been noted, it is too early to detect improvements in ecosystems. The NAPAP report did note improvements in the acidity of lakes and streams in some cases in North America, but the results have been spotty. Most forests in the United States have not experienced measurable degradation in health as a result of sulfur and/or nitrate deposition; therefore, it is very difficult or impossible to say that improvements in ecosystem function or health have been observed. The report concludes that for ecosystems that have suffered impairments in function due to high loading of SO_2 or NO_3, i.e., high elevation coniferous forests, large-scale improvements in health are expected to occur slowly. Processes such as accelerated soil leaching of nutrients is a gradual process and it may be many decades, or on the order of centuries, before improvements can even be measured. As such, the deposition resulting from RHPP is not expected to constitute a perceivable impact on forest, soil, or aquatic processes either locally or regionally.

4.22.3 Geology

The direct and indirect geologic impacts of the action alternative, and the resultant construction and operation of the generating facility, lignite mine, and utility connections, are described in Section 4.3. Adoption of the action alternative would not result in cumulative impacts to geological resources such as the potential for earthquakes or the future recovery of minerals in the area including the EcoPlex.

4.22.4 Soils

The Red Hills Power Project would result in the long-term loss of about 650 acres of prime farmland soils from the construction of permanent generation facility and mine facilities. Additional prime farmland soils would be disturbed by mining operations; all areas disturbed by mining, however, would be restored to a productivity level at least as high as premining conditions. Development of the EcoPlex could impact up to about 500 acres of prime farmland soils. Based on the Farmland Conversion Impact Rating score of 104 for the loss of prime farmland soils due to the combination of the RHPP and the EcoPlex (see Section 4.4.1.3), the cumulative impacts to prime farmland soils are insignificant and insufficient to require consideration of alternative sites (USDA-SCS 1984).

4.22.5 Groundwater Resources

Cumulative impacts on groundwater resources resulting from the construction and operation of the RHPP would primarily affect groundwater availability in the Tuscaloosa Aquifer System (TAS) and the Lower Wilcox Aquifer (LWA). Current uses of these aquifers are described in Section 3.5.3. As described in Sections 4.5.1.1 and 4.5.1.2, the drawdown in the LWA would be insignificant and restricted to the immediate vicinity of the RHPP site. Impacts to the TAS would also be insignificant. There would be little change to water quality in either aquifer.

The largest foreseeable future potential user of groundwater, aside from increased pumping by local public water supply systems to meet anticipated population growth, is the EcoPlex industrial park. As currently proposed, the EcoPlex would require a supply of at least 0.5 million gallons per day of water. If this is pumped from the TAS, either from the same wells proposed to supply the RHPP or from a separate well in the same area, it would result in a 7% increase over the amount pumped to supply the RHPP. The cumulative impacts to this aquifer would be insignificant.

4.22.6 Surface Water Resources

4.22.6.1 Probable Hydrologic Consequences

No significant cumulative impacts on surface water resources are anticipated to result from construction and operation of the Red Hills Power Project. Of the three major stream systems draining the project area, the lowest level of direct and indirect impacts would be to the Noxubee River system, which would be impacted by new utility corridors. This system also drains the town of Sturgis, and would be affected by resulting secondary development. Potential localized impacts include those associated with construction runoff (primarily sediment) and increased wastewater loading from failed septic systems.

The Noxubee River watershed within the Choctaw County and each adjacent county is not considered to be impaired for any of the state's designated uses (MDEQ 1996). Assuming use of stormwater BMPs, compliance with applicable environmental regulations, and correction of any failed septic systems, potential cumulative impacts from additional growth in the area would be expected to be insignificant.

The primary cause of impacts to the Big Black River system would be mine construction and operation activities within the watershed of its Big Bywy Ditch tributary. The pond treating storm runoff from the generation facility ash management unit would also discharge into this watershed. The direct impacts to this watershed, as described in Sections 4.6.1 and 4.6.2, would be restricted to the generation facility and mine sites and a short, downstream stretch of Big Bywy Ditch. No other large developments are foreseeable in this portion of the drainage, and the cumulative impacts of the RHPP on this watershed downstream of the RHPP area would be insignificant. However, as indicated in Section 3.6.1.3, the portion of the Big Bywy Ditch watershed within Choctaw County is included in the list of impaired waters within the state, indicating a need for judicious planning for additional growth in the area.

The potential is also small for cumulative impacts to the Yockanookany River system. A portion of the generation facility site, as well as the EcoPlex industrial park, would drain to Besa Chitto Creek, a major tributary to the Yockanookany. The generation facility would be a zero-discharge facility except for stormwater runoff, which would enter a treatment pond. Any point discharges from the EcoPlex (as well as from the generation facility) would be required to meet NPDES permit limits. BMPs and NPDES permits would minimize the potential for adverse impacts from both the generation facility and the EcoPlex. This system also drains the Towns of Ackerman and Weir, and would be affected by resulting secondary development. Potential localized impacts include those associated with construction stormwater runoff (primarily sediment) and increased wastewater loading from existing treatment plants at Ackerman and Weir. The lagoon systems at Ackerman and Weir are currently operating under capacity. The systems experience problems typical of small communities including excessive infiltration/inflow and intermittent and temporary fluctuations in effluent quality. All municipal systems in the region including these two are considered to be in compliance with their NPDES permits according to the Mississippi Department of Environmental Quality. Assuming use of stormwater BMPs and compliance with applicable environmental regulations, potential impacts from additional growth in the area would be expected to be insignificant. However, as indicated in Section 3.6.1.3, the portion of the Yockanookany River watershed in both Choctaw County and the adjacent Attala County, included in the list of impaired waters with the state, is an indication of the need for judicious planning for additional growth in the area.

4.22.7 Aquatic Ecology

No significant cumulative impacts to aquatic communities are anticipated to result from construction and operation of the RHPP. Direct and indirect impacts are described in Section 4.7. These impacts would be confined to the immediate vicinity of the project site and a few downstream miles of streams draining the project site. Some cumulative impacts would result from the land clearing and road construction associated with the EcoPlex industrial park and area population growth and commercial development.

Impacts from EcoPlex development would be minimized through the use of BMPs; in addition, the EcoPlex would not have large point discharges to area streams.

4.22.8 Wetlands

Wetlands make up a very small proportion (< 1%) of the land cover in the study area. Construction and operation of the Red Hills Power Project would eliminate about 67 acres of wetlands. This wetland loss would be mitigated in accordance with US Army Corps of Engineers requirements. About ten acres of additional wetlands occur within the area of the proposed EcoPlex industrial park. These are narrow, linear, palustrine forested and palustrine scrub-shrub wetlands associated with Besa Chitto Creek. The ultimate number of wetland acres and types of wetlands impacted depends on the size, number, and requirements of the companies locating in the EcoPlex. Permitting requirements by the US Army Corps of Engineers would apply to all development activities impacting wetlands in the EcoPlex project area, and mitigation would be required, thus offsetting any cumulative wetland impacts in the EcoPlex project area. (EcoPlex developers have not filed permit requests with the COE and it may be some time before engineering and design of the industrial park advances to the point where such permits should be sought.) There would be some temporary loss of wetland functions associated with the EcoPlex, during the time required for mitigated wetlands to develop a mature mosaic of wetland vegetation and habitat. Some additional loss of wetland acreage could occur as the result of additional land use changes/conversion of wetlands occurring in the overall project area, not associated with the RHPP.

Because of wetland mitigation requirements, cumulative impacts to wetlands would be minor and, for the most part, temporary. The locations of some mitigation wetlands have not yet been determined; if they are outside of the RHPP area, there would a significant loss of local wetland values and functions.

Regional cumulative impacts to wetlands would be insignificant. The majority of wetlands affected in the project area are forested wetlands. Trends in wetland loss indicate palustrine wetlands have declined by about 66% (1.09 million acres) in Mississippi, from 1780 to 1980 (Dahl 1990). The primary cause of loss of this type of wetland in Mississippi is conversion to agriculture (USGS 1996). The largest remaining contiguous area of forested wetlands in Mississippi is located on the lower Yazoo Basin, encompassing approximately 140,000 acres (USGS 1996). Of this area, 87,000 acres are protected from development in the Delta National Forest and Panther Swamp National Wildlife Refuge (USGS 1996). The wetlands affected by the RHPP and EcoPlex represent significantly less than 0.001% of the remaining palustrine wetlands in Mississippi (approximately 660,000 acres).

4.22.9 Floodplains

As described in Section 4.9, the various RHPP components would be consistent with Executive Order 11988, Floodplain Management, and would not significantly alter local flood elevations. The only major foreseeable development within the same stream reaches potentially impacted by the RHPP is the EcoPlex industrial park, which would be located within the drainage basin of Besa Chitto Creek, a short distance downstream of the generating facility. The limits of the approximate 100-year floodplain on the portion of the EcoPlex site upstream of Sanders Road are shown on Figure 3.9-1. All buildings

associated with the EcoPlex would be located outside the limits of the 100-year floodplain which would ensure consistency with EO 11988. Access roads and support facilities would be constructed to minimize adverse floodplain impacts. Given these provisions, the potential cumulative floodplain impacts of the RHPP would be insignificant.

As described in Section 3.9, Choctaw County does not participate in the National Flood Insurance Program and no Flood Insurance Study has been published for Choctaw County. Therefore, any future development would take place without the benefit of identified floodplain areas and local floodplain regulations. Other future developments could result in floodplain impacts. The additional floodplain impacts caused by the RHPP, however, would be insignificant.

4.22.10 Terrestrial Ecology

Direct and indirect impacts to terrestrial ecology resulting from construction and operation of the Red Hills Power Project are described in Section 4.10. They include long-term losses of wildlife habitat on lands converted to industrial uses, reductions in plant and animal diversity on mined areas, and potential loss of uncommon plant communities. With the development of the EcoPlex industrial park and other likely development in the area, there is a high potential for cumulative impacts to terrestrial ecology.

The proportion of the major vegetation types on the 1,500 acre EcoPlex site (of which 1,000 acres would eventually be developed) are similar to those on the RHPP site, with about 80% of the area forested and most of the remainder in pasture and hayfields. No uncommon plant communities or unusual wildlife populations are known to occur on the EcoPlex site.

The greatest cumulative impact to terrestrial ecology would be the long-term loss of over 1,500 acres of relatively diverse habitats through conversion to industrial uses. Additional habitat would be lost in surrounding areas through residential and commercial development to support the RHPP and EcoPlex workers. Cumulative impacts to wildlife using open water habitats, such as herons and waterfowl, would be beneficial for the duration and possible permanent retention of the planned sedimentation ponds.

4.22.11 Threatened or Endangered Species

No plant, terrestrial animal, or aquatic animal species federally-listed as threatened or endangered, or proposed for such listing, are known to occur on, or in the vicinity of, the RHPP site. There would therefore be no cumulative impacts to federally listed species resulting from the construction and operation of the RHPP.

Construction and operation of the RHPP would potentially impact several populations of plants considered imperiled or rare and uncommon in the state of Mississippi. Where practicable, locations of these species would be avoided. If avoidance is not practicable, the impacted populations would be transplanted to protected locations, if feasible. Only one rare plant species, white turtlehead (see Table 3.11.1-1 for status) occurs within the boundaries of the proposed EcoPlex industrial park; this population is on the periphery of the site and could be avoided. Although detailed information on the status and

population trends of the impacted species elsewhere in Mississippi is incomplete, several other populations are known for each species and the cumulative impacts from the RHPP would be insignificant.

4.22.12 Land Use

Potential impacts on local land use resulting from the construction and operation of the proposed generation facility, lignite mine, and utility ROWs are discussed in Sections 4.12.1.1 and 4.12.1.2. The potential for cumulative impacts on land use, particularly from construction and operation of the proposed EcoPlex, are discussed here.

As stated in Section 4.12.1.2, operation of the generation facility and mine would result in some local and regional economic growth due to the immigration of workers and the creation of new industries or commercial ventures to serve the mine and the generation facility with goods and services. This growth would likely increase land use and demand for both residential and commercial uses.

As a planned industrial park, and because industries would be recruited, establishment of the proposed EcoPlex would likely have the net result of increasing economic and industrial growth in the local area and the region, perhaps more so than the mine and the generation facility. Although larger industrial tenants would be recruited to locate in the EcoPlex, smaller, supporting commercial enterprises are likely to establish in the vicinity. This secondary economic growth would have the effect of increasing demand for residential and commercial/industrial land.

Establishment and eventual population of the proposed EcoPlex would result in changes in onsite land uses. Of the 1,500 acres in the EcoPlex site, about 1,000 acres are expected to be used for industrial purposes. Currently, about 1,183 acres of the site is forested, with about 590 acres in pine (mostly plantations), 315 acres in hardwoods, and 95 acres of recent clear-cuts. About 244 acres are pasture land. The proposed site also contains 19 barns, 24 houses, 5 mobile homes, and 4 storage buildings. Current land uses, including residential, forestry, and agriculture, would be replaced by industrial uses as the EcoPlex is established.

The current value of timber on the EcoPlex site is estimated to be approximately $413,900, or about $350 per acre. If this timber were allowed to grow over a 40-year planning horizon, its value is estimated to increase to about $1,048,000 (or about $886 per acre), expressed in 1997 dollars. Assuming about one-fourth of the EcoPlex site would be cleared for industrial construction every five years, timber value over the next 40 years (expressed in 1997 dollars) is expected to increase slightly to about $436,700 (about $370 per acre). Liquidation of timber resources on the EcoPlex site is not expected to have a regional effect on timber supplies, but could have some local effects on timber prices.

4.22.13 Cultural and Historical Resources

Archaeological sites and historic structures, within the mine area would be evaluated in accordance with a Programmatic Agreement (PA) among MLMC, TVA, SHPO, and ACHP. Because procedures outlined

in the PA will fully comply with Section 106 of the National Historic Preservation Act, cumulative impacts on cultural and historical resources would be negligible.

The portion of the proposed EcoPlex area north of Besa Chitto Creek was included in the historic structure and archaeological surveys for the RHPP. Construction of EcoPlex facilities in this area could affect one archaeological resource site requiring further testing to determine eligibility for the National Register of Historic Places. In accordance with applicable regulations, the remainder of the EcoPlex site would be surveyed; if any sites encountered are ultimately determined eligible for the Register any adverse impacts would be appropriately mitigated prior to development.

4.22.14 Socioeconomics

As described in Section 2.6 of the DEIS, there are plans to develop the Red Hills EcoPlex industrial park near the RHPP site. As shown in Table 2.5-1, the first industries that are likely to locate in the park include greenhouses, either hydroponic or traditional; aquaculture; and a kenaf pulp mill. Based on the assumption of three greenhouse operations, three aquaculture operations, and one kenaf mill, these operations would probably employ between 270 and 480 workers, including some seasonal workers at the greenhouses. It is estimated that the total payroll of these operations would be from 9 to 11 million dollars (in 1997 dollars) per year. This additional payroll would result in an increase in income in the local labor market area (LMA) of 15 to 18 million dollars per year, with a total employment increase of from 500 to 900 workers. Purchases in the local area by these firms would also increase income and employment in the area; these impacts would be less than the payroll impacts.

Since 1970, population in the LMA, as shown in Table 3.14.1-1, has been increasing at a rate of about 0.55% per year, more slowly than the state growth of about 0.8% per year. The generation facility, mine operation, and the EcoPlex would temporarily add to this growth during construction. Operation of these facilities would increase the baseline growth as these facilities hire permanent employees. Some additional growth would be likely, were the EcoPlex to expand or attract other operations nearby. Employment and income levels would also be likely to increase at a somewhat faster rate than in recent years. The amount of this population, employment, and income growth is highly speculative at this time; however, except for the facility construction period, this growth would likely continue to be near or below the state average. The additional growth from these activities would accelerate the urbanization processes already occurring within the LMA.

This additional growth in population, employment, and income would have positive impacts on local government revenues, but would also increase demand for community services, including schools, fire and police protection, medical care, and water and sewer services. However, the growth should provide enough additional income for local governments to increase their revenues more than enough to fund these increases in services, although it is possible that there could be an initial temporary gap.

4.22.15 Environmental Justice

The location of the proposed EcoPlex is within the area analyzed for the impacts of the generation facility and the mine, and the project would have no known disproportionate impacts on disadvantaged populations. Other growth that could occur would not, in general, be expected to have disproportionate impacts, although it is possible that some individual projects could. These are not foreseeable at this time.

4.22.16 Transportation Facilities

Construction and operation of the Red Hill Power Project facilities would impact the transportation systems surrounding the project area, as described in Section 4.16. With the development of the proposed EcoPlex industrial park and other foreseeable development in the area, the RHPP would also result in cumulative impacts to area transportation systems.

Cumulative impacts to the natural gas distribution system would be slight, as would impacts to air transportation facilities. Development of the EcoPlex would provide more impetus for building a rail connection to the RHPP/EcoPlex area. This would increase the rail traffic in the area, but should not cause any stress on the system. The major impacts to the transportation facilities would be felt on the road system.

The roads surrounding the project site were analyzed for conditions during the operation of the generation facility, mine, and EcoPlex similar to the way they were analyzed in Section 4.16.1.2 for the operation of the generation facility and mine alone. The projected traffic volumes for EcoPlex operation were calculated using projected data for the potential industries (Table 2.5-1) and equations that relate land use to traffic (Institute of Transportation Engineers 1991). These volumes were added to the projected volumes for the generation facility and mine to produce a cumulative peak hour volume, and a LOS analysis (see Section 3.16.3) was performed using these numbers.

The results of the analysis can be seen in Table 4.22.16-1. The additional traffic from the generation facility, mine, and the EcoPlex would stress the system and present a decrease in LOS provided on all roads surrounding the project. Since this study assumed that the entrance to the EcoPlex would be along Pensacola Road, the most dramatic change would be noticed there. A LOS of D was predicted for this roadway. Several options would be available to mitigate this problem, including changes to the geometry of Pensacola Road, staggering work schedules so that not everyone arrives in the same hour, and restricting deliveries during shift changes. Alternatively, the entrance to the EcoPlex could be relocated or supplemented with another access point on another roadway (either Highway 415 or Highway 9) to lessen the impact on Pensacola Road.

The results also indicate that Highway 82 and Highway 9 would be at LOS D due to the additional traffic. This means that both roads would be at capacity for the peak hour, and improvements should be considered for both. The predicted LOSs for the remaining roads were lower than existing LOSs, but did not fall below LOS D. These conditions can be tolerated for short periods of time.

Table 4.22.16-1 Levels of Service Due to Cumulative Impacts

Road Name	Cumulative Peak Hr. Volume (Vehicles)	Existing LOS	Cumulative LOS
Pensacola Road	1880	A	D
Highway 415	487	A	B
Highway 9	1711	B	D
Y Road	795	A	B
Highway 15	981	A	C
Natchez Trace Parkway	553	A	B
Highway 12	1269	C	C
Highway 82	1429	C	D

4.22.17 Public Health

Worker Injury and Illness

Worker injury and illness impact on local emergency response services during construction and operations of the EcoPlex would be about one per week. Table 4.22.17-1 gives the injury and illness estimates. The construction and operation of the EcoPlex would cause an insignificant impact on the local ambulance and emergency medical resources.

Table 4.22.17-1 Estimated Worker Injury Impact on Emergency Medical and Ambulance Services of EcoPlex Construction and Operations

			Expected Recordable Injuries and Illnesses		
Project Phase	BLS Rate (100#/year)[1]	Estimated Worker Populations	Yearly	Monthly	Weekly
Construction	9.7	300	29	2 to 3	<1
Peak Construction	9.7	400	39	3	<1
Operations	9.9[2]	480	48	4	1

[1] 1995 BLS total recordable injury rate.

[2] BLS nondurable goods manufacturing injury and illness rate.

When these estimates of injuries and illnesses are added to those of the RHPP (Table 4.17.1.1-1), these estimates range from as low as two per week to as many as five or six per week. During operations, the low end of this range is expected, but during peak construction of the RHPP and EcoPlex, the high end is expected. Two injuries or illnesses per week requiring emergency or medical response would have an insignificant impact on existing facilities and services. Five or six per week could have a moderate to significant impact possibly necessitating a communication and response agreement. This high-end estimate would be only for the few months of peak construction which would mitigate any long-term impact.

Any future growth in the EcoPlex would proportionally increase the potential for worker injuries and illnesses and the need for emergency services. As the need increases, the community or industries would probably respond so that the impact would be mitigated.

Catastrophic Release of Hazardous Materials

There is a very small likelihood that there will be any cumulative effects from the catastrophic release of hazardous materials from the operations of the generation facility and future EcoPlex industries because of the very small chance of having simultaneous releases. The potential impact of a catastrophic hazardous materials release from either the generation facility or the EcoPlex would probably be less than a truck accident along Highway 9 causing the release of its hazardous cargo. These stationary sources would be required to have a Risk Management Plan (RMP) in place before operations begin. The RMP covers registration of the owner or operator and hazardous materials, the offsite consequences analysis, any pertinent accident history, facility's release prevention program, and the emergency response and notification program. None of this type of information is usually available to local authorities at the time of a vehicle accident. Also, there is warning time and dilution distance before a hazardous materials plume leaves the facility site.

Owners and operators of stationary sources must also comply with OSHA's Process Safety Management of Highly Hazardous Chemicals Standard, 29 CFR 1910.119. This standard covers much of the same areas as EPA's and also covers operating procedures to provide clear instructions for safely conducting all activities associated with these hazardous materials. Even though the potential impact from one of these releases is potentially significant, the oversight and requirements provided by EPA and OSHA

regulations greatly reduce the likelihood of such releases and better ensure that the proper response would be taken should a release occur.

Additional cumulative impacts from the release of hazardous materials might come from industries moving into the EcoPlex. This impact would be small, both because the new industries would have to comply with EPA and OSHA standards cited above, and because, in keeping with the EcoPlex development philosophy, tenants would, to the maximum extent practicable, avoid the use and production of hazardous materials.

Air Pollutants

Construction and operation of the RHPP and industries in the EcoPlex would cause the emission of air pollutants. Applicable regulations restrict the emission of air pollutants to protect the public health and assure that NAAQS are attained and maintained. The results of the atmospheric modeling of emissions from the RHPP and EcoPlex facilities shown in Table 4.22.2-1 and Table 4.2.1.2-10 indicate that the NAAQS should be met and that levels of any hazardous air pollutants would be very low and substantially below guideline levels.

4.22.18 Hazardous and Solid Waste

Potential impacts resulting from hazardous and solid wastes generated by the Red Hills Power Project are described in Section 4.18. Through a combination of reuse, recycling, minimizing waste production, substitution of nonhazardous materials, offsite disposal of hazardous and nonhazardous wastes, and some onsite disposal of nonhazardous bulk wastes, impacts from RHPP waste generation would be insignificant.

The cumulative impacts from hazardous and solid wastes would also be insignificant. Additional waste streams would be generated in the area by the proposed EcoPlex industrial park and other developments. In keeping with its philosophy, EcoPlex developers and tenants would aggressively work to minimize waste production, use wastes as feedstocks for complementary EcoPlex tenants, and recycle wastes elsewhere. Any remaining wastes would be disposed of offsite or recycled offsite at state-approved facilities, and cumulative impacts to these facilities would be insignificant.

4.22.19 Noise

4.22.19.1 Construction

Hearing Loss

Construction of the kenaf pulp mill in the EcoPlex should follow the same construction phases as the generation facility. Building of the aquaculture fish farm and greenhouse facilities would not be complex industrial construction projects and are not included in this review of potential construction noise impacts. The exact location of the kenaf pulp mill construction is not known. As a worst case, it is assumed, for hearing loss impact, that the closest receptors are about 900 to 950 meters (2950 to

3120 feet) away along Perry Road and Highway 9. The following table presents the L_{eq} and L_{DN} noise exposures at the nearest receptor residences during the five phases of construction.

Table 4.22.19.1-1 Construction Phase Noise Emissions and Receptor Exposure Levels from the Kenaf Pulp Mill Construction

Construction Phase	Noise Emissions L_{eq} at 15.4 m	Sound Power L_w	Exposure L_{eq} at Closest Receptor 900 m (2950 ft)	L_{DN} at Closest Receptor	Distance to 70 dBA L_{eq}
Site Prep.	84 dBA	119	44 dBA	42 dBA	282 m
Excavation	89 dBA	124	49 dBA	47 dBA	501 m
Foundation	78 dBA	113	38 dBA	36 dBA	141 m
Erection	85 dBA	120	45 dBA	43 dBA	316 m
Finishing	89 dBA	124	49 dBA	47 dBA	501 m

Calculations in Table 4.22.19.1-1 for the sound power, L_{eq} and L_{DN} noise levels at the closest receptor, and the distance to the 70 dBA level followed the same procedure as described for the generation facility construction, Sections 4.19.1.1 and 4.19.1.2.

None of the projected construction noise levels at the closest receptor are above EPA's recommended L_{eq} (24) of 70 dBA to protect hearing loss for lifetime exposure. The projected exposure levels at the closest receptor to the construction of the kenaf pulp mill will have no impact on the hearing loss of the residents.

Cumulative impacts to hearing loss potentially occur if receptors are in the noise emissions areas from two or more of the construction sites of the RHPP and EcoPlex. As with the individual construction sites, EPA's 70 dBA $L_{eq}(24)$ is the level of first interest. The addition of noise levels at a given location is found by summing the acoustic energy of the multiple sources and recalculating the $L_{eq}(24)$. The maximum increase in noise level from two or more sources occurs when the sources are the same. This means that 70 dBA $L_{eq}(24)$ can be reached by having two sources emitting 67 dBA $L_{eq}(24)$ to a given location or three at 65 dBA or four at 64 dBA. Using the highest construction noise emissions of 89 dBA for excavation and finishing, none of the sites emit noise near to these levels at their closest receptors. There would be no cumulative hearing loss impact from the RHPP and EcoPlex construction.

The noise emitted from the construction of the transmission line and pipeline would cause no cumulative impact on hearing loss either. These are short-term construction activities at any given location and might cause exposures for a few days at the longest. The 70 dBA level of concern is for a lifetime exposure.

Other construction taking place because of the proximity of the generation facility or EcoPlex would also have the limited noise emissions coverage area, as described above, and would not pose an impact to the hearing loss of adjacent residents.

Annoyance

Intruding construction noise from the kenaf pulp mill does not exceed 50 dBA at the closest receptor and would not impact outdoor communication. Self-reported annoyance should be insignificant because the intruding L_{DN}s are substantially less than the background L_{DN}s of 56 to 60 dBA at the closest receptor on Perry Road and along Highway 9.

Cumulative annoyance impact from the intruding noise levels should be insignificant for the construction of the RHPP and kenaf pulp mill. The closest, mutual receptor for the generation facility and kenaf mill is in the Perry Road area. At this location, the generation facility construction site emits a L_{DN} of about 46 dBA and the kenaf mill construction site emits a L_{DN} of 47 dBA from the noisiest construction phases. The cumulative L_{DN} is about 50 dBA. This intruding noise level is about the same as the background levels and does not cause a communication or significant annoyance concern. It should be an insignificant impact.

4.22.19.2 Operations

Hearing Loss

The noise emissions projection from the EcoPlex was not modeled by Hunt (1997). Using the total sound power given in Table 4.22.19.2-1 the projected noise at the closest receptor on Perry Road is calculated to be 46 dBA. This calculation includes the same attenuation assumptions that were used in the construction impact calculations (Section 4.19.1.1). A 46 dBA noise level would not impact the hearing loss of the closest residents.

Table 4.22.19.2-1 EcoPlex Operational Noise Sources and Sound Power Levels

Facility	Noise Source	Sound Power, L_w, dBA
Kenaf Pulp Mill	Process air compressor	115
Aquaculture Fish Farm	Roof top ventilation	111
Greenhouses	Ventilation fans (75)	119
	Total	121

As with the discussion of the hearing loss impact from construction, the cumulative exposure of 70 dBA is the level of concern. At the closest, mutual receptor on Perry Road for the generation facility and EcoPlex, the respective intruding noise levels are 51 and 46 dBA, giving a cumulative exposure level of 52 dBA. All other cumulative exposures among the generation facility, lignite mine, and EcoPlex are less than this level. There would be no cumulative hearing loss impact from the simultaneous operations of these facilities.

Annoyance

The noise emissions from the EcoPlex would probably vary a little from day to night. The kenaf pulp mill would operate 24 hours per day and the aquaculture fish farm and hydroponic greenhouses would not. The daytime intruding noise at the closest receptor to the EcoPlex would be about 46 dBA and the nighttime would be about 44 dBA. The expected L_{DN} would be 51 dBA. As with the generation facility and lignite mine, this level of intruding noise is not expected to be a significant impact. It is substantially

less that the background L_{DN}s. But also, like the other sites, the operations of the EcoPlex can be expected to cause some sporadic complaints from adjacent residents for subjective reasons.

The combined noise emissions from the generation facility and EcoPlex would give a noise exposure of about 52 dBA during the day and at night, even though two of the EcoPlex plants would not operate at night. (These levels are the same because of the dominance of the generation facility noise emissions.) The combined L_{DN} at the nearest mutual receptor in the Perry Road areas would be about 58 dBA. At L_{DN}s of 55 to 60 dBA, the speech intelligibility interference rates are about 1% and 5%, respectively. This in-between level could begin to cause noticeable outdoor communication interference. It is not high enough to cause any indoor interference.

Self-reported annoyance from the combined operational noise exposure could be in the 9% to 13% range at this L_{DN} range. An estimate of the affected population includes all residences on Perry Road, along Highway 9 from Pensacola Road to the Y Road, residences along Pensacola Road between the generation facility and Chester, and one on Sanders Road. This includes about 17 residences or 51 people. Applying the reporting percentages to this estimated affected population gives a range of five to seven people who would be expected to report annoyance from the combined intruding noise. This affected population has average background L_{DN}s of 56 to 60 dBA, see Table 3.19.4-1, sites 5, 6, and 7. The operations of the generation facility and kenaf pulp mill would be heard in these areas and probably a few people would be annoyed. This same area would be expected to have an intruding L_{DN} a little above the EPA guideline of 55 dBA, which also indicates that some people might be disturbed.

The completion of the RHPP and EcoPlex would probably cause an increase in residential building and occupancy. Service industries, such as gas stations and convenience stores, would also be expected. As the local population increases so does the background noise level. The long-term impact would be a gradual increase in ambient noise levels.

4.22.20 Recreation

The cumulative effects of the proposed projects, as well as continued population growth as experienced the last 25 years, would exert increased pressure on the existing public recreation facilities. The availability of recreation facilities would become increasingly important. There would continue to be a need for additional facilities such as sports fields, multi-use courts, and possibly a public golf course. There would also be a need to increase the opportunities for more passive recreational activities such as camping, picnicking, fishing, hiking, and nature walking. Available open space would likely decline due to increased population, increased industrial activity, and the accompanying increase in service industries. This would put increased pressure on the available hunting land and would likely decrease the amount of available hunting acreage.

4.22.21 Visual Resources

General

The cumulative visual impact from the RHPP, the EcoPlex, and other likely development (Figure 4.21.1.-1) would be a shift in visual character, from primarily rural woodland and commercial forest to moderate industrial development in a rural setting. It would be a change from foreground views of predominantly natural features to more frequent views of large man-made structures and features. Visible human activities would shift from those related to forest and agriculture toward those related to industry. The multi-story generation facility and any EcoPlex structures, as well as ROW cuts through the forest, would add vertical forms that are a discordant contrast to current low structures and horizontal forms of woodlands and ridges. The large-scale structures seen above tree lines, through deciduous woods in the winter, and in middle or background vistas, would increase adverse variety and contrast. Scenic integrity and harmony in the landscape would be reduced. The additional quantity of trucks and some cars would increase time that vehicles are a dominant element in the foreground views from homes. They would also impact local traffic by adding visual congestion. Night sky brightness would increase, as described in the Night Sky section below. There would be a cumulative loss of visual tranquillity, scenic integrity, and coherence in the rural landscape.

These changes would impact views seen by motorists on primary and secondary roads in the area, as well as from farms, homes, and churches along the roads. The degree of impact is somewhat dependent on the location, size, density, and type of vegetation in their immediate foreground views.

Mine

Assuming that all structures and equipment related to mine operations are removed and site restoration is complete as planned, there would be few cumulative adverse impacts to the visual landscape of the mined area. The reconstructed terrain would result in some slopes less steep than before mining. If forest restoration is primarily evergreen, there would be a cumulative loss of variety and seasonal vividness. If landowner preferences shift vegetation restoration from forests to more pasture, there would be an increase in variety with some loss of intactness or wholeness. Assuming the lake and possibly a few sedimentation ponds remain, they would add large surface water areas not currently present. Added water features and more pasture land would provide a cumulative increase of compatible variety, interest, and harmony while maintaining visual coherence of the rural landscape. The cumulative visual impact of the reclaimed mine area could be more positive than negative.

These changes would primarily impact views seen by traffic and homes rebuilt along secondary internal roads. Homes and traffic along perimeter roads would only see the changes occasionally, as long as foreground woodland buffers remain intact.

EcoPlex

Construction of the EcoPlex industrial park would change a rural landscape (1/5 pasture, 4/5 woodland) to a light industrial area. About 500 acres would be developed initially, and up to 1,000 acres when complete. Multiple construction sites and operating plants are anticipated over a period of several years, beginning with a couple of initial tenants and supporting infrastructure. The anticipated industrial structures and activities would adversely impact the visual landscape and forest continuity by introducing features which are not in scale, character, or harmony with the rural countryside. Visual impacts would broaden as more rural woodland and pasture are developed to house the increasing population attracted by employment. The significance of visual impacts would increase as they are viewed by a growing number of people.

Seven tenants are initially anticipated for the EcoPlex site, including three greenhouse operations, three aquaculture operations, and a kenaf pulp mill. A variety of large-scale structures similar to, but lower in height than the generation facilities, are anticipated. They may include various buildings, stacks, cooling towers, conveyance structures, transformer yards, material or waste stockpiles, parking, utilities, and yard features.

Depending on facility locations, the stacks and other structures may be seen from one or more places on Pensacola, Sanders, Chaney, and Perry Roads, as well as Highways 15, 9, and 415. These views could expand somewhat when leaves are gone, and could also expand as a result of clear-cut timber harvesting in the surrounding area. Views from the roads could be reduced by timber and other vegetative growth in the immediate foreground. The plumes from stacks and cooling towers would be seen from the same and possibly other locations. The shape, size, and duration of these plumes would vary with changes in season and atmospheric conditions, as previously described in the Visibility Section of Section 4.2.

It has been assumed the entire site would be surrounded by a visual buffer of evergreen trees, 150 feet wide. Timing and growth of buffers, screening, use of berms, and other mitigation activities would determine the extent of impact reduction. To the extent screening and other mitigation is not effective, the industrial park would impact the visual landscape by adding adverse variety and reducing unity, coherence, and harmony. Scenic integrity could be low.

Truck traffic for the EcoPlex operations is assumed to be about 30% of the generation facility (at least 15 round trips per day). Trucks and employee traffic (up to 480 round trips per day) would increase time that vehicles are a dominant element in the foreground views of traffic and residents along nearby roads. The added traffic volume would increase visual congestion. Construction traffic could further increase these visual impacts during the development years.

Night lighting for EcoPlex construction and operations would increase the night sky brightness a measurable amount, as discussed in the Night Sky section. On an annual average, this would impact astronomical viewing of skies with little or no cloud cover, on about 200 nights. Rainwater Observatory and the Natchez Trace Parkway would be affected as would farms, homes, and local traffic in the surrounding area.

To help mitigate visual impacts, EcoPlex development standards could be established to guide the architectural character of structures, the application of "dark sky" shielded and low pressure sodium (LPS) lighting, screening and enhancement planting, signs, and other issues related to visual continuity both within and outside the industrial park.

Night Sky

For the seven tenants, it is assumed that one greenhouse would require 50% as much light as the generation facility, and the other greenhouses, the aquaculture operations, and the pulp mill would require 30%, 30%, and 100% as much light as the generation facility, respectively (Clanton 1997). In total, the EcoPlex site would have about three times the lighting needs of the generation facility during operation. The lighting needs of the EcoPlex during construction were assumed to be three times the amount needed for operation (Appendix D-7). Table 4.22.21-1 compares the range of estimated brightness increases from shielded and unshielded lights, based on the estimated range of EcoPlex lighting needs. Dark Sky (shielded) lighting is based on guidelines in Appendix D-7. Because the initial tenants would probably not all build at the same time, construction estimates in the table show the worst case.

Table 4.22.21-1 Estimated Increases in Nighttime Sky Brightness due to EcoPlex Only

	Construction		Operation	
As viewed from:	Typical Lighting (Unshielded)	"Dark Sky" Lighting (Shielded)	Typical Lighting (Unshielded)	"Dark Sky" Lighting (Shielded)
Rainwater Observatory	1.12 to 2.39 times	1.08 to 1.90 times	1.04 to 1.46 times	1.03 to 1.30 times
Jeff Busby developed area	2.22 to 14.88 times	1.52 to 6.86 times	1.41 to 5.63 times	1.27 to 4.01 times

The effects of increases in background sky brightness on the contrast and visibility of the Milky Way, Little Dipper, and other astronomical objects are discussed in Section 3.21. The amount of increased brightness depends on the actual amount of light used at the EcoPlex facilities.

If typical lighting is used for EcoPlex operations, the brightness increase would be noticeable at the observatory, with impacts similar to those described above. The impact would be greater at Jeff Busby developed area and for nearby residents, with parts of the Milky Way and Little Dipper visible only occasionally. The process of mitigating the brightness increase would consist of several steps. These include evaluating the need for various nighttime activities, determining the appropriate lighting level and frequency for these activities, minimizing the quantity and use of lights, then implementing appropriate "dark sky" lighting techniques. Mitigation with shielded lighting would reduce the brightness increase for the Park and local residences, allowing the Milky Way and fainter stars of the Little Dipper to be visible to the naked eye more often. Mitigation with shielded and LPS lighting would provide benefits similar to those described above for telescope users at the observatory.

For any stacks and other tall structures in the EcoPlex, a nighttime aviation warning device that makes repetitive strobe flashes would significantly impact telescope use and photography at the observatory. To mitigate this impact, a dual lighting system in accordance with FAA Advisory Circular AC 70/7460-1J (1/1/96) should be selected. Using medium-intensity strobes during the day and only steady red lights at night would eliminate the impact on telescope-aided viewing.

Airborne dust and smoke would have a negative effect on the observatory, to the extent it adds haze to a clear night sky. The impact can be greater if the wind is from the northeast, which occurs about 15% of the year in this area.

Tables 4.22.21-2 and 4.22.21-3 show overall estimates of increases in sky brightness during construction and operation, respectively. These cumulative impacts, e.g., generation facility/mine, and generation facility/mine/EcoPlex for each phase (construction and operation), assume that all individual activities would be in the same phase concurrently. For construction effects, this would be the worst case condition.

Table 4.22.21-2 Overall Estimated Increases in Nighttime Sky Brightness During Construction

	Mine and Generation Facility		Mine, Facility, and Ecoplex	
As viewed from:	Typical Lighting (Unshielded)	"Dark Sky" Lighting (Shielded)	Typical Lighting (Unshielded)	"Dark Sky" Lighting (Shielded)
Rainwater Observatory	1.02 to 1.12 times	1.01 to 1.08 times	1.14 to 2.50 times	1.09 to 1.98 times
Jeff Busby developed area	1.47 to 3.39 times	1.30 to 2.55 times	3.28 to 24.73 times	2.48 to 16.42 times

Table 4.22.21-3 Overall Estimated Increases in Nighttime Sky Brightness During Operation

	Mine and Generation Facility		Mine, Facility, and Ecoplex	
As viewed From	Typical Lighting (Unshielded)	"Dark Sky" Lighting (Shielded)	Typical Lighting (Unshielded)	"Dark Sky" Lighting (Shielded)
Rainwater Observatory	1.03 to 1.32 times	1.02 to 1.21 times	1.07 to 1.79 times	1.05 to 1.52 times
Jeff Busby developed area	2.07 to 12 times	1.69 to 8.14 times	2.53 to 17.7 times	2.0 to 11.85 times

4.23 Unavoidable Adverse Impacts

Selection of the preferred alternative would result in construction and operation of the generation facility, mine, transmission line, and natural gas pipeline. Many of the resulting adverse environmental impacts would be avoided, minimized, or mitigated through compliance with applicable regulations. Nevertheless, some unavoidable adverse impacts would occur.

About 45 occupied houses would be displaced from the generation facility and mine sites. About five of these displacements would be permanent. The remaining landowners within the mine area could rebuild following mine reclamation. Landowners within the mine area would also lose temporary access and use of their property as it is being mined and reclaimed. The temporary and permanent rerouting and/or closure of roads through the project area would increase travel time for some area residents.

About 1,200 acres would be permanently converted from predominantly forest and agricultural uses to industrial land. The current forest and agricultural production of this land would be eliminated, and its present biodiversity would be greatly reduced. An additional 3,800 acres would be impacted by mine operations. A few miles of streams within this area would be rerouted and the diversity of their aquatic life would be reduced. Some of this diversity would eventually recover. Plants and terrestrial animals would be eliminated from areas being mined. Although reclaimed mine areas would be replanted with grasses, forbs, and trees, both the number of plant species present and the structural complexity of the vegetation would be greatly reduced from premining conditions. This would result in a long-term reduction in the local diversity of plants and terrestrial animals.

The visual character of the project area would be adversely impacted as the generation facility and EcoPlex sites are permanently converted to industrial uses. The large-scale discordant structures and features of the RHGF and EcoPlex would reduce harmony, scenic integrity, and visual tranquillity in the landscape. Service truck and employee traffic would become a more dominant visual element and would increase visual congestion. The added transmission towers and periodic plumes from cooling structures and facility stacks would be seen in the daytime sky above tree lines.

Replanting the former hardwood forest with mostly pine, interspersed with fish and wildlife features during mine reclamation would impact the visual character of the area with a loss of variety and seasonal vividness. Although reclamation activities would restore the general premining topography, some of the steep slopes would be eliminated, further reducing the visual character of the area.

Nighttime lighting from the generation facility, mine, and EcoPlex would increase night sky brightness and reduce visibility of astronomical objects. Mitigation with shielded fixtures, LPS lights, and a dual aviation warning system would minimize impacts to telescope users at the observatory. For local residences and the Natchez Trace Parkway, mitigation with shielded lighting would only reduce added brightness about 35% as seen by the naked eye.

The generation facility would emit about 3.5 million tpy of carbon dioxide and 1,080 tpy of NOx, contributing slightly (0.2%) to the global increase in greenhouse gases.

The potential for economical recovery of the two deepest seams of lignite in the mine area would be greatly reduced after the area is reclaimed.

4.24 Irreversible or Irretrievable Commitments of Resources

An irreversible commitment of a resource is the use or consumption of a resource which is either non-renewable or only renewable over long time periods. An irretrievable commitment is the loss of production or use of renewable natural resources.

The construction and operation of the Red Hills Power Project would result in a major, irreversible commitment of about three million tpy of lignite used to fuel the generation facility. About 100 million standard cubic feet of natural gas would also be consumed by the generation facility. Other commitments of fuels include the energy used to operate the lignite mine, primarily diesel fuel and electricity generated from coal and nuclear plants, and the fuels used during construction of the project components.

Other commitments of non-renewable resources include materials such as metals, plastics, ceramics, chemicals, and masonry used in the manufacturing, construction, and maintenance of the project components. Many of these materials, however, can be recycled at the end of their useful life.

Prime farmland soils on the generation facility site and a portion of the mine site would be taken out of production. Land on the generation facility site, on portions of the mine site, and along the proposed transmission line and natural gas pipeline ROWs would be deforested for portions of the life of the project.

4.25 Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Short-term environmental impacts resulting from the Red Hills Power Project are primarily related to construction of the various project components and to the operation of the lignite mine. These temporary impacts include reductions in forest cover and prime farmland soils, alteration of stream channels, reductions in fish and wildlife populations, and increased noise from construction activities. Many of these impacts would be mitigated by mine reclamation.

Long-term environmental impacts extending throughout the life of the project include the conversion of land to industrial uses, loss of forest cover from portions of the project area, alteration and loss of diversity of some plant and animal communities, elimination of springs and reduction in headwater streamflows in the mine area, increased highway traffic, increased noise, loss of undeveloped rural landscapes, and increased nighttime sky brightness.

Several long-term benefits would also result from the Red Hills Power Project. The long-term productivity of postmining soils would be at least equal to or potenially increased. There would also be significant economic benefits to the project area, including jobs created by the construction and operation of the project, purchases of goods and services, and increased tax collections. These local economic benefits would occur in an area with lower per capita income, and higher proportion of persons below the poverty level than state and national averages.

5. SUPPORTING INFORMATION

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Mr. Heevis Swindle
Route 3, Box 310-A
Eupora, Mississippi 39744

Mr. Mike Taquino
802 Hogan Street
Starkville, Mississippi 39759

Mr. John Tennant
P.O. Box 351
Ackerman, Mississippi 39735

Mr. Levi Tennyson
Route 3, Box 57
Ackerman, Mississippi 39735

Mr. Bin Tennyson
Route 3, Box 59
Ackerman, Mississippi 39735

Mr. James Tennyson
Route 3, Box 59
Ackerman, Mississippi 39735

Ben and Linda Tharp
904 Michelle Drive
Winona, Mississippi 38967

Mr. Stan Thieling
Office of Geology
Mississippi Department of
Environmental Quality
P.O. Box 20307
Jackson, Mississippi 39289-1307

Mr. Michael Thomas
Choctaw County Schools
179 South Dewey Street
Ackerman, Mississippi 39735

Dr. Ed Thompson
State Health Officer
Mississippi Department of Health
P.O. Box 1700
Jackson, Mississippi 39215-1700

Mr. Garret Thompson
Route 2, Box 28-A
McCool, Mississippi 39108

Mr. George Thrailkill
350 East Cherry Street
Ackerman, Mississippi 39735

Mr. Donald Threadgill
Chaussey Clerk
P.O. Box 250
Ackerman, Mississippi 39735

Ms. Sally Tipton
Box 908
Ackerman, Mississippi 39735

Mr. Johnny Timmons
P.O. Box 588
Tupelo, Mississippi 38802

Mr. John Turner
P. O. Box 271
Columbus, Mississippi 39703

Mr. Thomas Underwood
P. O. Box 513
Batesville, Mississippi 38606

Mr. Jimmy Upchurch
Route 3, Box 113
Ackerman, Mississippi 39735

James and Jean Upchurch
Route 3, Box 46B
Ackerman, Mississippi 39735

Mr. Alec VanRyan
205 Coachmans Road South
Madison, Mississippi 39110

Mr. David Vincent
French Camp Academy
French Camp, Mississippi 39745

Mr. Marty Walker
Box 908
Ackerman, Mississippi 39735

Mr. Roger WalkerTeddy and Betty Walker
1955 Reed Road
Starkville, Mississippi 39760

Glen and Lillie Walker
2002 Highway 12 West
Starkville, Mississippi 39759

Mr. Roger Walker
State Historic Preservation Officer
Mississippi Department of
Archives and History
Post Office Box 571
Jackson, Mississippi 39205-0571

Mr. Gene Wardlaw
MEC
P.O. Box 9144
Jackson, Mississippi 39286

Mr. Ronnie Ware
Choctaw County Schools
P.O. Box 396
Ackerman, Mississippi 39735

Mr. Don Watts
P.O. Box 10385
Jackson, Mississippi 39289-0385

Mr. Bill Weaver
Route 3, Box 136A
Ackerman, Mississippi 39735

Mr. Earl Weeks
P.O. Box 351
Columbus, Mississippi 39703

Mr. Mitch Weeks
Route 1
Weir, Mississippi 39772

Mr. Evan Weiher
Mississippi State University
P.O. Drawer GY
Mississippi State, Mississippi 39762

Mr. William Wilson
Route 2, Box 55B
Ackerman, Mississippi 39735

Mr. Jerry Wise
136 East Sides Avenue
Ackerman, Mississippi 39735

Mr. James Wise
170 South Louisville Street
Route 2
Ackerman, Mississippi 39735

Mr. Doug Wise
Route 1, Box 129A
Ackerman, Mississippi 39735

Mr. Jim Wiseman
U.S. Army Corps of Engineers
Vicksburg District
4155 Clay Street
Vicksburg, Mississippi 39180-3435

Mr. Andy Woods
P.O. Box 510
Louisville, Mississippi 39339

Mr. Eric Wright
Route 1, Box 73C
Eupora, Mississippi 39744

Ms. Elizabeth Yarbrough
189 Yarbrough Drive
Ackerman, Mississippi 39735

Mr. Will Yates
Route 3, Box 68-A
Ackerman, Mississippi 39735

Leake County Board of Supervisors
Leake County Courthouse
Carthage, Mississippi 39051

Attala County Board of Supervisors
Attala County Courthouse
Kosciusko, Mississippi 39090

Oktibbeha County Board of Supervisors
Oktibbeha County Courthouse
Starkville, Mississippi 39759

Choctaw County Board of Supervisors
P.O. Box 250
Ackerman, Mississippi 39735

Webster County Board of Supervisors
P.O. Box 398
Walthall, Mississippi 39771

Winston County Board of Supervisors
P.O. Box 734
Louisville, Mississippi 39339

NEW MEXICO

Mr. John Geddie
8040 Bellamah Ct. NE
Albuquerque, New Mexico 87110

TENNESSEE

TVERC
P.O. Box 1842
Knoxville, Tennessee 37901-1842

Mr. Angus McEhchran
495 Union Avenue
Memphis, Tennessee 38103

TEXAS

Mr. John Michael Arne
Phillips Coal Company
2929 North Central Expressway
Suite 200
Richardson, Texas 75080-2043

Mr. Paul Thompson, President
Phillips Coal Company
2929 North Central Expressway
Richardson, Texas 75080-2043

Mr. James A. Luppens
Phillips Coal Company, Suite 200
2929 North Central Expressway
Richardson, Texas 75080-2043

Traci R. Hampton
Tractebel Power, Inc.
1177 West Loop South
Suite 900
Houston, Texas 77027

Mr. Paul Margaritis
Tractebel Power, Inc.
1177 West Loop South
Suite 900
Houston, Texas 77027

Mr. George Vaught
Horizon Environmental Services, Inc.
P. O. Box 162017
Austin, Texas 78716

DISTRICT OF COLUMBIA

Senator Thad Cochran
United States Senate
326 Russell Senate Office Building
Washington, DC 20510

Mr. Dan Hamson
National Park Service
Administrative Program Center
1849 "C" Street N.W., Room 2749
Washington, DC 20240

Mr. Dan Kimball
National Park Service
Administrative Program Center
1849 "C" Street, N.W., Room 3223
Washington, DC 20510

Senator Trent Lott
United States Senate
487 Russell Senate Office Building
Washington, DC 20510

Congressman Charles W. "Chip" Pickering
United States House of Representatives
427 Rayburn House Office Building
Washington, DC 20515

Congressman Roger Wicker
United States House of Representatives
206 Cannon House Office Building
Washington, DC 20515

Appendix A-1 Notice of Intent

[Federal Register: October 16, 1996 (Volume 61, Number 201)]
[Notices]
[Page 53988-53990]
From the Federal Register Online via GPO Access [wais.access.gpo.gov]

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TENNESSEE VALLEY AUTHORITY

Environmental Impact Statement: Lignite Power Generation Facility, Choctaw County, MS

AGENCY: Tennessee Valley Authority.

ACTION: Notice of Intent.

SUMMARY: The Tennessee Valley Authority (TVA) will prepare an environmental impact statement (EIS) for a proposed surface lignite coal mine and associated 400 megawatt (MW) lignite coal-fired power plant at a location near the City of Ackerman in Choctaw County in northeastern Mississippi. TVA's proposed actions are the purchase of all or part of the electric power output of the proposed power plant and interconnecting the plant with the TVA power system. The power plant will be owned by a joint venture of the Phillips Coal Company and CRSS, Inc.

DATES: Comments on the scope of the EIS must be postmarked no later than November 15, 1996. TVA will conduct a public meeting in the Ackerman, Mississippi area to discuss the project and obtain comments on the scope of the EIS. The location and time of this meeting are described below in the Scoping Process section.

ADDRESSES: Written comments should be sent to Charles P. Nicholson, National Environmental Policy Act Specialist, Tennessee Valley Authority, mail stop: WT 8C, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499. Comments may also be e-mailed to cnichols@tva.gov.

FOR FURTHER INFORMATION CONTACT: Charles Bach, Tennessee Valley Authority, mail stop: CTR 1D, Muscle Shoals, Alabama 35662-1010. E-mail may be sent to idwhc@tva.gov.

SUPPLEMENTARY INFORMATION:

TVA's Integrated Resource Plan

In TVA's Integrated Resource Plan and Final Environmental Impact Statement, Energy Vision 2020, issued in December 1995, TVA evaluated the need for additional energy resources to meet customer demands in the TVA region and recognized that Independent Power Producers such as this project could fulfill part of the projected needs.

Project Description

A joint venture consisting of CRSS, Inc. and Phillips Coal Company submitted a proposal to TVA for the sale of the total electric power output from the 400 MW power plant. The power plant would use two circulating fluidized bed generating units and burn lignite coal from an adjacent deposit.

Phillips Coal Company owns the rights to extensive lignite coal deposits in northeastern Mississippi. Its proposed North Chester Mine would be designed to produce in excess of three million tons per year of lignite coal for a period of 30 years to supply the power plant. The mine is expected to be a surface mine that will use draglines and a truck and shovel operation to remove the overburden, mine the lignite coal, and reclaim the site. The lignite coal would likely be transported to the power plant by truck and/or overland conveyor. Over the life of the mine, about 4,275 acres would be disturbed and reclaimed.

TVA would connect the power plant to the TVA power distribution system by building a 161-kV, two-circuit, loop connection to the existing Sturgis-Eupora 161-kV transmission line and a 161-kV connection to the existing Louisville substation. These connections would be about 5 and 25 miles long, respectively.

In addition, a rail loop off of the Kansas City Southern and/or Columbus and Greenville railroads, a natural gas pipeline tap and lateral from nearby existing natural gas pipelines, and a water well field and pipeline may also be part of the project.

Although not part of the power plant or lignite coal mine that are the subjects of this EIS, it is anticipated that the power plant would be located in an “EcoPlex” industrial park being planned by the State of Mississippi. Although the EcoPlex is not part of TVA's proposed action, this EIS will assess appropriate cumulative impacts of the power plant, mine and EcoPlex. The EcoPlex could also supply the mine-power plant complex with water and waste disposal services.

The EcoPlex would combine various manufacturing, energy production, and service businesses at a common location to help achieve the highest levels of efficiency in terms of energy consumption and joint feedstock/waste utilization. The types of industries that might best be suited for this type industrial park in northeastern Mississippi include: newsprint and other paper and wood products manufacturing and recycling industries; food processing; various recycling industries;

industries that use gypsum as feedstock, such as manufacturers of wallboard, cement, and agrichemicals; brick and ceramic manufacturers; specialized aqua-and agriculture industries; and transportation fuel manufacturers.

Proposed Issues to be Addressed

The EIS will discuss the need for the proposed project and describe the existing environmental, cultural, recreational, and socioeconomic resources. It will describe the plant siting and location process, transportation methods for coal and other raw materials, mining methods and their potential environmental impacts. Mine reclamation plans will be discussed as will environmental impacts resulting from construction, operation, and maintenance of the proposed facilities; specifically, impacts to air quality, surface and ground water quality and resources, vegetation, wildlife, aquatic ecology, endangered and threatened species, wetlands and wetland wildlife, aesthetics and visual resources, land use, cultural and historic resources, light, and noise. These concerns and other important issues identified during the scoping process as well as engineering and economic considerations will be used to select a preferred power plant location near the North Chester Mine, mine plan, and other plant processes as appropriate.

Alternatives

In addition to the proposed alternative of purchasing all or part of the electric power output from the power plant, TVA will also consider a ``no action'' alternative which would be not to purchase the output from the plant. In addition, alternative power plant designs, mining and reclamation plans, and lignite coal transport methods may be considered. TVA invites the public to comment on the proposed action and any or all of the alternatives suggested above or to suggest other possible alternatives.

Scoping Process

Scoping, which is integral to the EIS process, is a procedure that solicits public input to the EIS process to ensure that: (1) issues are identified early and properly studied; (2) issues of little significance do not consume substantial time and effort; (3) the EIS is thorough and balanced; and (4) delays caused by an inadequate EIS are avoided. TVA's procedures implementing the National Environmental Policy Act require that the scoping process commence after a decision has been reached to prepare an EIS in order to provide an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. The scope of issues to be addressed in an EIS will be determined, in part, from written comments submitted by mail, and comments presented orally or in writing at a public scoping meeting. The preliminary identification of reasonable alternatives and environmental issues provided in this notice is not meant to be exhaustive or final. TVA

considers the scoping process to be open and dynamic in the sense that alternatives other than those given above may warrant study and new matters may be identified for potential evaluation.

The scoping process will include both interagency and public scoping. The agencies expected to participate in interagency scoping include the National Park Service, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and various State of Mississippi agencies including the Department of Environmental Quality, Department of Wildlife, Fisheries, and Parks, the Department of Economic and Community Development, State Historic Preservation Office of the Department of Archives and History, and other federal, state and local agencies as appropriate.

The public is invited to submit written comments or e-mail comments on the scope of this EIS no later than the date given under the DATES section of this notice and/or attend the public scoping meeting. TVA will conduct a public meeting on the scope of the EIS in Ackerman, Mississippi on Tuesday, October 29, 1996. The meeting will be held at Ackerman High School, which is located at 280 East Main Street. Registration for the meeting will be from 6:00 to 6:30 p.m. with the meeting beginning at 6:30 p.m. There will be visual displays and information handouts available during the registration period. The meeting will begin with brief presentations by representatives of TVA, Phillips Coal Company and CRSS, Inc. explaining the proposed project and the EIS process. Following this presentation there will be small group discussions facilitated by TVA staff to record the issues and concerns that the public believes should be considered in the EIS.

Upon consideration of the scoping comments, TVA will develop alternatives and identify important environmental issues to be addressed in the EIS. Following analysis of the environmental consequences of each alternative, TVA will prepare a draft EIS for public review and comment. Notice of availability of the draft EIS will be published by the Environmental Protection Agency in the Federal Register. TVA will solicit written comments on the draft EIS, and information about possible public meetings to comment on the draft EIS will be announced. TVA expects to release a final EIS by September 1998.

Dated: October 7, 1996.
Kathryn J. Jackson,
Senior Vice President, Resource Group.
[FR Doc. 96-26414 Filed 10-15-96; 8:45 am]
BILLING CODE 8120-01-P

Appendix A-2 Advertisements

In October 1996, advertisements for the scoping meeting were placed in the following:

- Choctaw Plaindealer
- Kosciusko Star Herald
- Winston County Journal
- Winona Times
- Webster Progress Times
- West Point Daily Times
- Starkville News

The RHPP EIS public scoping meeting was held on Tuesday , October 29, 1996, at the Ackerman High School Auditorium at 6:30 p.m.

Appendix B-1 Plant Species Proposed for Use in Reclaiming Red Hills Mine

Common Name	Scientific Name	Specialized Use
Temporary Cover		
Grasses		
Annual ryegrass	*Lolium multiflorum*	
Japanese millet	*Echinochloa vesicula*	
Oats	*Avena sativa*	
Pearl millet	*Perrisetum glaucum*	
Rye	*Secale cereale*	
Sorghum sudangrass hybrids	*Sorghum* spp.	
Wheat	*Triticum vulgare*	
Forbs		
Arrowleaf clover	*Trifolium vesiculum*	
Crimson clover	*Trifolium incarnatum*	
Hairy vetch	*Vicia villose*	
Sesbania	*Sesbania macrocarpa*	
Permanent Cover		
Grasses		
Bahiagrass	*Paspalum notatum*	Wildlife habitat enhancement
Bermudagrass	*Cynodon dactylon*	
Big bluestem	*Andropogon gerardii*	Wildlife habitat enhancement
Cane	*Arundinaria gigantea*	Wildlife habitat enhancement
Carpetgrass	*Axonopus affines*	Wildlife habitat enhancement
Cattail	*Typha latifolia*	Wildlife habitat enhancement
Common reed	*Phragmites australis*	Wildlife habitat enhancement
Green sprangletop	*Leptochioa dubia*	
Indiangrass	*Sorghastrum nutans*	
Kleingrass 75	*Panicum coloratum*	Wildlife habitat enhancement
Rescuegrass	*Bromus unioloides*	Wildlife habitat enhancement
Switchgrass	*Panicum virgatum*	Wildlife habitat enhancement
Tall fescue	*Festuca arundinacea*	Wildlife habitat enhancement
Forbs		
Annual phlox	*Phlox drummondii*	Roadside beautification
Arrowleaf clover	*Trifolium vesiculum*	Wildlife habitat enhancement
Black-eyed susan	*Rudbeckia hirta*	Roadside beautification
Bluebonnets	*Lupinus texensis*	Roadside beautification
Butterflyweed	*Asclepias tuberosa*	Roadside beautification
Clasping coneflower	*Rudbeckia amplexicaulis*	Roadside beautification
Common sunflower	*Helianthus annuus*	Wildlife habitat enhancement, roadside beautification

Common Name	Scientific Name	Specialized Use
Crimson clover	*Trifolium incarnatum*	Wildlife habitat enhancement
Hairy vetch	*Vicia villosa*	Wildlife habitat enhancement
Lance-leaved coreopsis	*Coreopsis tinctoria*	Roadside beautification
Lemon beebalm	*Monarda citriodora*	Roadside beautification
Maximillian sunflower	*Helianthus maximiliani*	
Moss verbena	*Verbena tenuisecta*	Roadside beautification
Partridge pea	*Cassia fasciculata*	Wildlife habitat enhancement
Prairie verbena	*Verbena bipinnatifida*	Roadside beautification
Red gilla	*Ipomopsis rubra*	Roadside beautification
Red mexican hat	*Ratibida columnaris*	Roadside beautification
Thickspike gayfeather	*Liatris pychnostachya*	Roadside beautification
<u>Shrubs and Vines</u>		
American beautyberry	*Callicarpa americana*	Wildlife habitat enhancement
Blackberry	*Rubus spp.*	Wildlife habitat enhancement
Carolina jasmine	*Gelsemium sempervirens*	Wildlife habitat enhancement
Chokecherry	*Prunus virginiana*	Wildlife habitat enhancement
Greenbriar	*Smilax* spp.	Wildlife habitat enhancement
Hawthorn	*Crataegus* spp.	Wildlife habitat enhancement
Muscadine grape	*Vitis rotundifolia*	Wildlife habitat enhancement
Waxmyrtle	*Myrica cerifera*	Wildlife habitat enhancement
Wild grape	*Vitis spp.*	Wildlife habitat enhancement
Winterberry	*Ilex verticillata*	Wildlife habitat enhancement
Yaupon	*Ilex vomitoria*	Wildlife habitat enhancement
<u>Trees</u>		
American holly	*Ilex opaca*	Wildlife habitat enhancement
Bald cypress	*Taxodium distichum*	Wildlife habitat enhancement
Black cherry	*Prunus serotina*	Wildlife habitat enhancement
Black walnut	*Juglans nigra*	Wildlife habitat enhancement
Black willow	*Salix nigra*	Wildlife habitat enhancement
Blackgum	*Nyssa sylvatica*	Wildlife habitat enhancement
Blackjack oak	*Quercus marilandica*	Wildlife habitat enhancement
Bur oak	*Quercus macracarpa*	Wildlife habitat enhancement

Common Name	Scientific Name	Specialized Use
Crabapple	*Pyrus ioensis*	Wildlife habitat enhancement
Eastern red cedar	*Juniperus virginiana*	Wildlife habitat enhancement
Flowering dogwood	*Cornus florida*	Wildlife habitat enhancement
Hickory	*Carya* spp.	Wildlife habitat enhancement
Loblolly pine	*Pinus taeda*	
Longleaf pine	*Pinus palustris*	Wildlife habitat enhancement
Overcup oak	*Quercus lyrata*	Wildlife habitat enhancement
Post oak	*Quercus stellata*	Wildlife habitat enhancement
Red maple	*Acer rubrum*	Wildlife habitat enhancement
Redbud	*Cercis canadensis*	Wildlife habitat enhancement
River birch	*Betula nigra*	Wildlife habitat enhancement
Sassafras	*Sassafras albidum*	Wildlife habitat enhancement
Shortleaf pine	*Pinus echinata*	Wildlife habitat enhancement
Shumard oak	*Quercus shumardii*	Wildlife habitat enhancement
Southern red oak	*Quercus falcata*	Wildlife habitat enhancement
Sweetgum	*Liquidambar styraciflua*	
Water oak	*Quercus nigra*	Wildlife habitat enhancement
White oak	*Quercus alba*	Wildlife habitat enhancement
Wild cherry	*Vitis* spp.	Wildlife habitat enhancement
Wild plum	*Prunus americana*	Wildlife habitat enhancement
Willow oak	*Quercus phellos*	Wildlife habitat enhancement

Appendix B-2 Specifications for Transmission Lines

RIGHT-OF-WAY CLEARING SPECIFICATIONS

1. General - The Contractor shall plan and carry out operations by techniques consistent with good engineering and management practices. The Contractor will protect areas that are to be left unaffected by access or clearing work at and adjacent to all work sites.

   If the Contractor fails to use best management practices or to follow contract specifications, TVA will order corrective changes and additional work as necessary in TVA's judgment to meet the intent of environmental laws and regulations or other guidelines.

   Major violations or continued minor violations will result in work suspension until correction of the situation is achieved or other agreeable remedial action is taken.

2. Regulations - The Contractor shall comply with all applicable Federal, state, and county antipollution laws and regulations, including air pollution, water, solid and hazardous waste, noise, and nuisance ordinances. He shall secure all necessary permits or authorizations to conduct work on the acres shown on the drawings and plan and profile under this contract. The designated project manager, specified in writing to TVA, will actively seek to prevent, control, and abate all recognized forms of workplace and environmental pollution. Permits or authorizations shall be documented with copies submitted to TVA's right-of-way inspector for information before work begins.

3. Land and Landscape Preservation - The Contractor shall exercise care to preserve the condition of the cleared soils avoiding as much compacting and deep scarring as possible. In areas outside the clearing, use, and access areas, the natural vegetation shall be protected from damage. The Contractor and his employees must not deviate from delineated access routes of use areas. Employees must not enter other than designated areas that will be marked. Clearing operations shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the remaining natural vegetation and adjacent surroundings in the vicinity of the work.

   Disturbance of ground cover in areas other than row crop fields must be immediately repaired by grass seeding, strawing, or other means to prevent leaving a surface exposed to rain or runoff. As many rooted ground cover plants and stumps must be left in place as possible along streams, ditches, and wet areas. In such zones, stumps shall be high cut and may be treated to prevent resprouting. All existing tree zones following the streams will be hand cut across their entire width. In other wet areas, a 100-foot zone around them will be hand cleared with high stumps left in the wet areas. The soil conditions must be preserved by appropriate methods immediately after the right-of-way is hand cleared in the zones along streams, ditches, and drainage areas.

   Trees, limbs, and debris shall be removed from streams, ditches, and wet areas minimizing dragging or scarring the banks or stream bottom. No debris will be left in the water or watercourse. Equipment will cross streams, ditches, or wet areas only at designated points.

4. Sensitive Area Preservation - If prehistoric or historic artifacts or features that might be of archaeological significance are discovered during clearing operations, the activity shall immediately cease within a 100-foot radius, and TVA right-of-way inspector or construction superintendent and the Cultural Resources Program Manager shall be notified. The site shall be protected and left as found until a determination about the resources, their significance, and site treatment is made by TVA's Cultural Resources Program.

5. Water Quality Control - The Contractor's clearing and disposal activities shall be performed by best management practices methodology that will prevent erosion and entrance of runoff, spillage, contaminants, debris, and other pollutants or objectionable materials into drainage ways and prevent blockage of watercourses. Special care shall be exercised in refueling equipment to prevent spills. Fueling areas shall be remote from any stream or waterway. Burning debris will be kept away from streams and ditches and shall be incorporated into the soil.

6. Turbidity - If temporary clearing activities interrupt natural drainage, appropriate drainage facilities shall be provided to avoid further flow disruption, erosion and/or siltation.

7. Air Quality Control - The Contractor shall take actions required to limit the amount of air emissions created by clearing and disposal operations to remain well within the limits of clearing permits. All operations must be conducted in a manner which prevents nuisance conditions or damage to adjacent land, crops, dwellings, or people.

8. Dust - Clearing activities shall be conducted to minimize the creation of fugitive dust. This may require limitation as to type of equipment, allowable speeds, and routes utilized. Control measures such as water, gravel, etc., or similar measures may be used subject to TVA approval.

9. Burning - The Contractor shall obtain applicable permits and approvals to conduct controlled burning. The Contractor will comply with all provisions of the permit including burning site locations, controlled draft, burning hours, and such other conditions as stipulated. If weather conditions rapidly change such as wind speed or wind direction, the Contractor's burning operation may be temporarily stopped by TVA's project engineer. The debris to be burned shall be kept as clean and dry as possible and stacked and burned in a manner to produce the minimum amount of smoke. Residue from burning will be disposed of according to permit stipulations. No fuel starters or enhancements other than kerosene will be allowed.

10. Smoke and Odors - The Contractor will properly store and handle combustible and volatile materials which could create objectionable smoke, odor, or fumes. The Contractor shall not burn oil or refuse that includes trash, rags, tires, plastics, or other manufactured debris.

11. Vehicle Exhaust Emissions - The Contractor shall maintain and operate equipment to limit vehicle exhaust emissions. Equipment and vehicles will be kept within the manufacturer's recommended limits and tolerances.

Excessive exhaust gases will be eliminated and inefficient operating procedures will be revised or halted until corrective repairs or adjustments are made.

12. Vehicle Servicing - Vehicles will not be serviced on the right-of-way, including changing of crankcase oil.

13. Noise Control - The Contractor shall take steps to avoid the creation of excessive sound levels for employees, the public, or the property owners.

    Concentration of individual noisy pieces as well as the hours and locations of operation should be considered.

14. Noise Suppression - All internal combustion engines shall be properly equipped with mufflers. The equipment and mufflers shall be maintained at peak operating efficiency.

15. Sanitation - The Contractor shall provide sanitary chemical toilets convenient to all principal points of operation for every working party. The facilities shall comply with applicable Federal, state, or local health laws and regulations. They shall not be located closer than 100 feet to any stream or tributary or to any wetland. The facilities shall be required to have proper servicing and maintenance, and the waste disposal contractor shall verify in writing that the waste disposal will be in state-approved facilities. Employees shall be notified of sanitation regulations and shall be required to use the toilet facilities.

16. Refuse Disposal - The Contractor shall be responsible for daily cleanup and disposal of all refuse and debris on the site as well as personal refuse and debris produced by operations and employees. Facilities which meet applicable regulations and guidelines for refuse collection will be required. Only approved transport, storage, and disposal areas shall be used.

ENVIRONMENTAL QUALITY PROTECTION SPECIFICATIONS
FOR TRANSMISSION LINE CONSTRUCTION

1. General - The Contractor shall plan, coordinate, and conduct his operations in a manner to protect the quality of the environment. This specification contains provisions which shall be considered in all the Contractor's operations. If the Contractor fails to operate within the intent of these requirements, TVA will direct changes to operating procedures. Continued violation will result in a work suspension until correction or remedial action is taken by the Contractor. The costs of complying with the Environmental Quality Protection Requirements are incidental to the contract work, and no additional compensation will be allowed. At all tower and conductor pulling sites, protective measures to prevent erosion will be taken during construction, and the protective measures shall be inspected and shall be maintained throughout the construction and right-of-way rehabilitation period.

2. Regulations - The Contractor shall comply with all applicable Federal, state, and local antipollution laws and regulations for the prevention, control, and abatement of all forms of pollution.

3. Use Areas - The Contractor's use areas include but are not limited to site office, shop, maintenance, parking, storage, staging, assembly areas, utility services, and access roads to the use areas. The Contractor shall submit plans and drawings for their location and development to the TVA engineer for approval. Secondary containment will be provided for fuel storage pursuant to 29CFR1910.106(D)(6)(iii)(OSHA) and 40CFR 110 (EPA).

4. Equipment - All major equipment and proposed methods of operation shall be subject to the approval of TVA. The use or operation of heavy equipment in areas outside the right-of-way, access routes, or structure, pole, or tower sites will not be permitted without permission of the TVA inspector. Heavy equipment use on steep slopes (greater than 20 percent) and in wet areas will be held to the minimum necessary to construct the transmission line. Steps will be taken to limit ground disturbance from heavy equipment which is used in these areas, and erosion control will be instituted immediately on disturbed areas.

   No ground-disturbing equipment or stump removal equipment will be used by construction forces except on access roads or at the actual structure, pole, or tower sites, where only footing locations and controlled runoff diversions shall be created that disturb the soil. All other areas of ground cover or inplace stumps and roots shall remain inplace.

   Water should not be allowed to pond on the structure sites except around foundation holes; the water must be led away from the site as gently as possible. At tower or structure sites some means of slope interruption of potential overland flow should be provided as the first step in construction-site preparation. If leveling is necessary, it must be implemented by means that provide for continuous gentle, controlled, overland flow or percolation. A good grass cover, straw, gravel, or other protection of the surface must be maintained. Steps taken to prevent increases in the moisture content of the in-situ soils will be beneficial both during construction and over the service life of any structure.

5. Sanitation - The Contractor shall provide sanitary chemical toilets convenient to all principal points of operation for every working party. The facilities shall comply with applicable Federal, state, or local health laws and regulations. They shall not be located closer than 100 feet to any stream or tributary or to any wetland. The facilities shall be required to have proper servicing and maintenance, and the waste disposal contractor shall verify in writing that the waste disposal will be in state-approved facilities. Employees shall be notified of sanitation regulations and shall be required to use the toilet facilities.

6. Refuse Disposal - The Contractor shall be responsible for daily inspection, cleanup, and disposal of all refuse and debris produced by his operations and his employees. Suitable refuse collecting facilities will be required. Only state-approved disposal areas shall be used.

7. Landscape Preservation - The Contractor shall exercise care to preserve the natural landscape in the entire construction area as well as use areas, in or outside the right-of-way, and on or adjacent to access roads. Construction operations shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the natural vegetation and surroundings in the vicinity of the work.

8. Sensitive Areas Preservation - Certain areas onsite and along the rightof-way may be designated by the specifications or the TVA engineer as environmentally sensitive. These areas include, but are not limited to areas classified as erodible, scenic, historical and archaeological, fish and wildlife refuges, water supply watersheds, and public recreational areas such as parks and monuments. The Contractor shall take all necessary actions to avoid adverse impacts to these sensitive areas. These actions may include suspension of work or change of operations during periods of rain or heavy public use; hours may be restricted or concentrations of noisy equipment may have to be dispersed.

   If prehistoric or historic artifacts or features are encountered during clearing operations, the operations shall immediately cease for at least 100 feet in each direction, and TVA's right-of-way inspector or construction superintendent and Cultural Resources Program shall be notified. The site shall be left as found until a determination is made by TVA's Cultural Resource Program.

9. Water Quality Control - The Contractor's construction activities shall be performed by methods that will prevent entrance or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into flowing streams, dry watercourses, lakes, ponds, and underground water sources. The Contractor will erect and maintain silt screens, multiple screens on steep slopes, at least 20 feet away from any waterway or water body. Screens will be inspected by the Contractor routinely and during periods of high runoff and repaired as needed. TVA will inspect the screens on a regular basis and after rain storm events. TVA will maintain a record of the inspections.

   Acceptable measures for disposal of waste oil from vehicles and equipment shall be followed. No waste oil shall be disposed of within the right-of-way.

10. Turbidity and Blocking of Streams - Construction activities near a stream or other body of water shall be controlled to prevent the water turbidity from exceeding state or local water quality standards for that stream. Watercourses shall not be blocked or diverted unless required by the specifications or the TVA engineer.

    Appropriate drainage facilities for temporary construction activities interrupting natural drainages shall be provided to avoid erosion. Mechanized equipment shall not be operated in flowing water except when approved to construct crossings or to perform required construction under direct guidance of TVA.

    Construction of stream fords or other crossings will only be permitted at approved locations and to current TVA construction access road standards.

    Material shall not be deposited in watercourses or within streambank areas where it could be washed away by high stream flows.

    When operations in a work area are complete, all temporary structures or fills installed to facilitate stream crossing shall be removed and the thread of the stream reestablished to prevent future erosion.

    Wastewater from construction or dewatering operations shall be controlled to prevent excessive erosion or turbidity in a stream. Any work or placing of equipment within a flowing or dry watercourse requires the prior approval of TVA.

11. Clearing - No construction activities may clear additional right-of-way vegetation or disturb remaining retained vegetation, stumps, or regrowth at locations other than the tower sites and conductor setup areas. The Contractor must immediately reseed, replant, or restabilize areas he has disturbed that have previously been restabilized after clearing operations.

12. Restoration of Site - All construction disturbed areas, with the exception of farmland under cultivation and any other areas as may be designated by TVA's specifications, shall be stabilized in the following manner unless the property owner and TVA's engineer specify a different method:

    A. The subsoil shall be loosened to a minimum depth of 6 inches and graded to remove ridges and depressions.

    B. Fertilizer (12-12-12) shall be applied at a rate of 400 pounds per acre.

    C. Grass areas shall be seeded evenly with a mechanical spreader at a rate of 70 pounds per acre and rolled using a cultipacker. Grass areas shall be seeded with Kentucky 31 fescue and legumes unless otherwise specified in writing by TVA.

    D. TVA holds the option, depending upon the time of year and weather condition, to delay or withdraw the requirement of seeding until more favorable planting conditions are certain. In the meantime other stabilization techniques must be applied.

13. Air Quality Control - The Contractor shall take all actions required to limit the amount of air pollution created by his construction operations as necessary to avoid creating a nuisance and to prevent damage to lands, crops, dwellings, or persons.

14. Burning - During allowed open burning operations, the Contractor shall obtain permits and comply with the requirements of state and local air pollution control and fire authorities. Burning will only be allowed in approved locations and during appropriate hours and weather conditions. If weather conditions rapidly change, such as wind direction, the Contractor's burning operations may be temporarily stopped by the TVA inspector. The debris for burning shall be piled and shall be kept as clean and as dry as possible, then burned in such a manner to reduce smoke.

15. Dust - Construction activities shall be conducted to minimize the creation of dust. This may require limitations as to types of equipment, allowable speeds, and routes utilized. Water, straw, wood chips, dust palliative, gravel, combinations of these, or similar control measures may be used subject to TVA's approval.

16. Vehicle Exhaust Emissions - The Contractor shall maintain and operate equipment to limit vehicle exhaust emissions. Equipment and vehicles that show excessive emissions of exhaust gasses and particulates due to poor engine adjustments or other inefficient operating conditions shall not be operated until corrective repairs or adjustments are made.

17. Smoke and Odors - The Contractor shall properly store and handle combustible material which could create objectionable smoke, odors, or fumes. The Contractor shall not burn refuse such as trash, rags, tires, plastics, or other debris. (See number 6.)

18. Noise Control - The Contractor shall take measures to avoid the creation of noise levels that are considered nuisances, safety, or health hazards. Critical areas, including but not limited to residential areas, parks, public use areas, and some ranching operations, will require special considerations. TVA's criteria for determining corrective measures shall be determined by comparing the noise level of the Contractor's operation to the background noise levels. Also, especially noisy equipment such as helicopters, pile drivers, air hammers, chippers, chain saws, or areas for machine shops, staging, assembly, or blasting may require corrective actions when required by TVA.

19. Noise Suppression - All internal combustion engines shall be properly equipped with mufflers as required by the Department of Labor's "Safety and Health Regulations for Construction." TVA may require spark arresters in addition to mufflers on some engines. Air compressors and other noisy equipment may require sound reducing enclosures in some circumstances.

20. Damages - The Contractor shall limit the movement of its crews and equipment so as to cause as little intrusion and damage as possible to crops, orchards, woods, wetlands, or other property features and vegetation and shall avoid marring the lands or their contents. The Contractor will be responsible for erosion damage and especially for creating soil conditions that would threaten the stability of the right-of-way soil, the structures, or access to either. When property owners prefer the correction of ground cover condition or soil and subsoil problems themselves, the section of the contract dealing with damages will apply.

Appendix C-1 Air Resources - Wind Roses

Figure C-1.1 Long-term wind direction and wind speed wind rose for Jackson, Mississippi - Annual 1961-1990 (Jan-Dec).

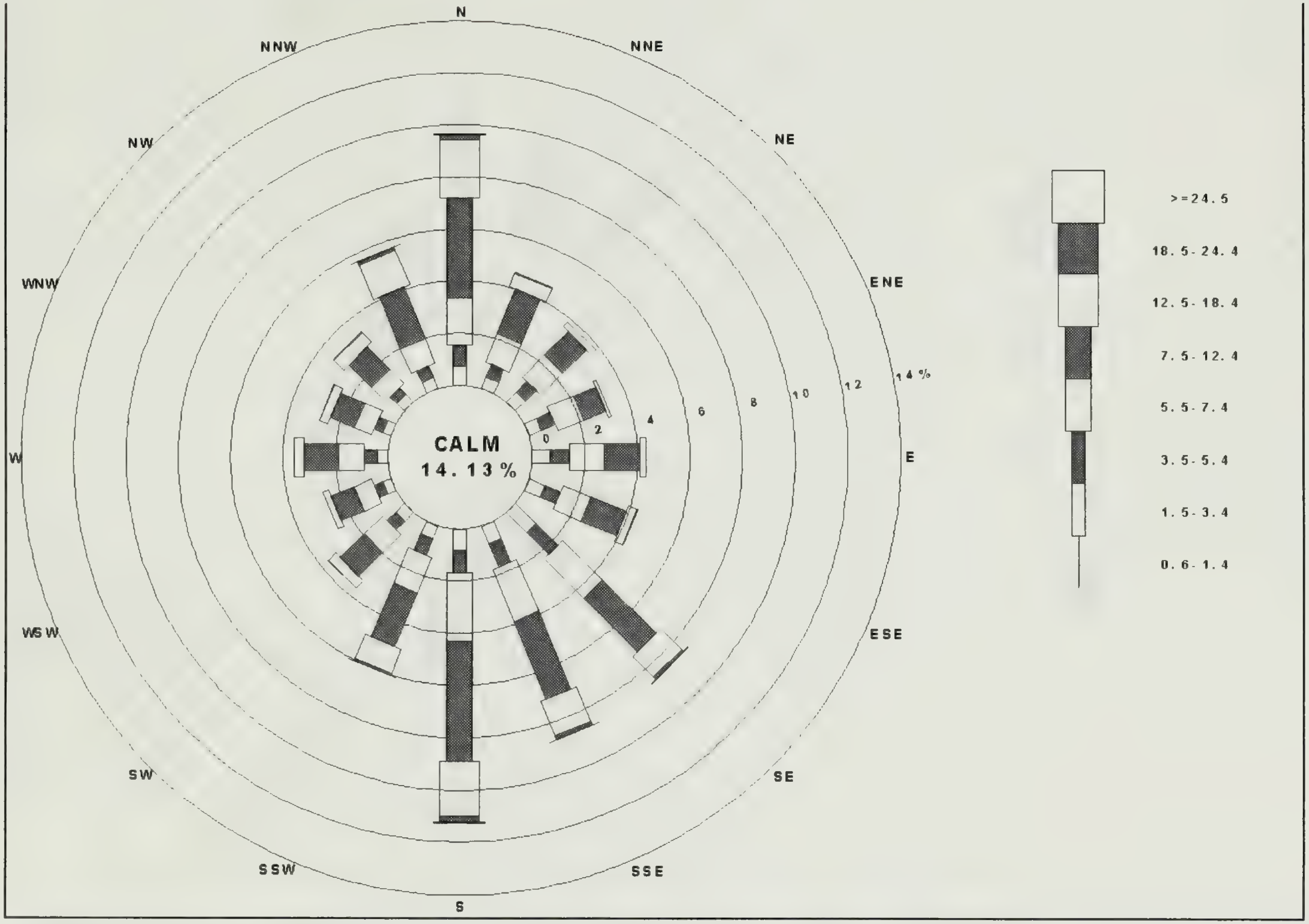


Figure C-1.2 Long-term wind direction and wind speed wind rose for Jackson, Mississippi - Winter 1961-1990 (Dec-Feb).

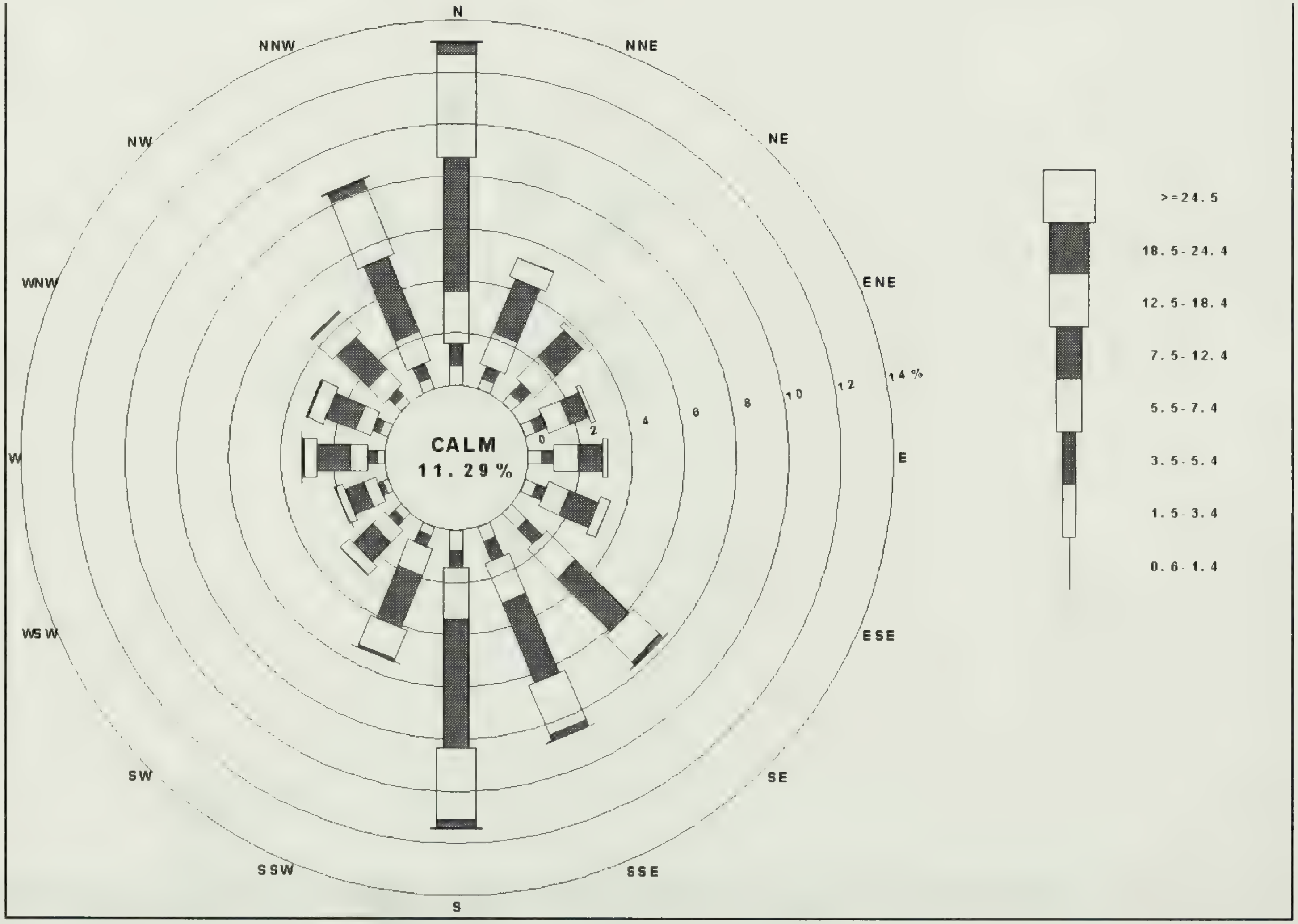


Figure C-1.3 Long-term wind direction and wind speed wind rose for Jackson, Mississippi - Spring 1961-1990 (Mar-May).

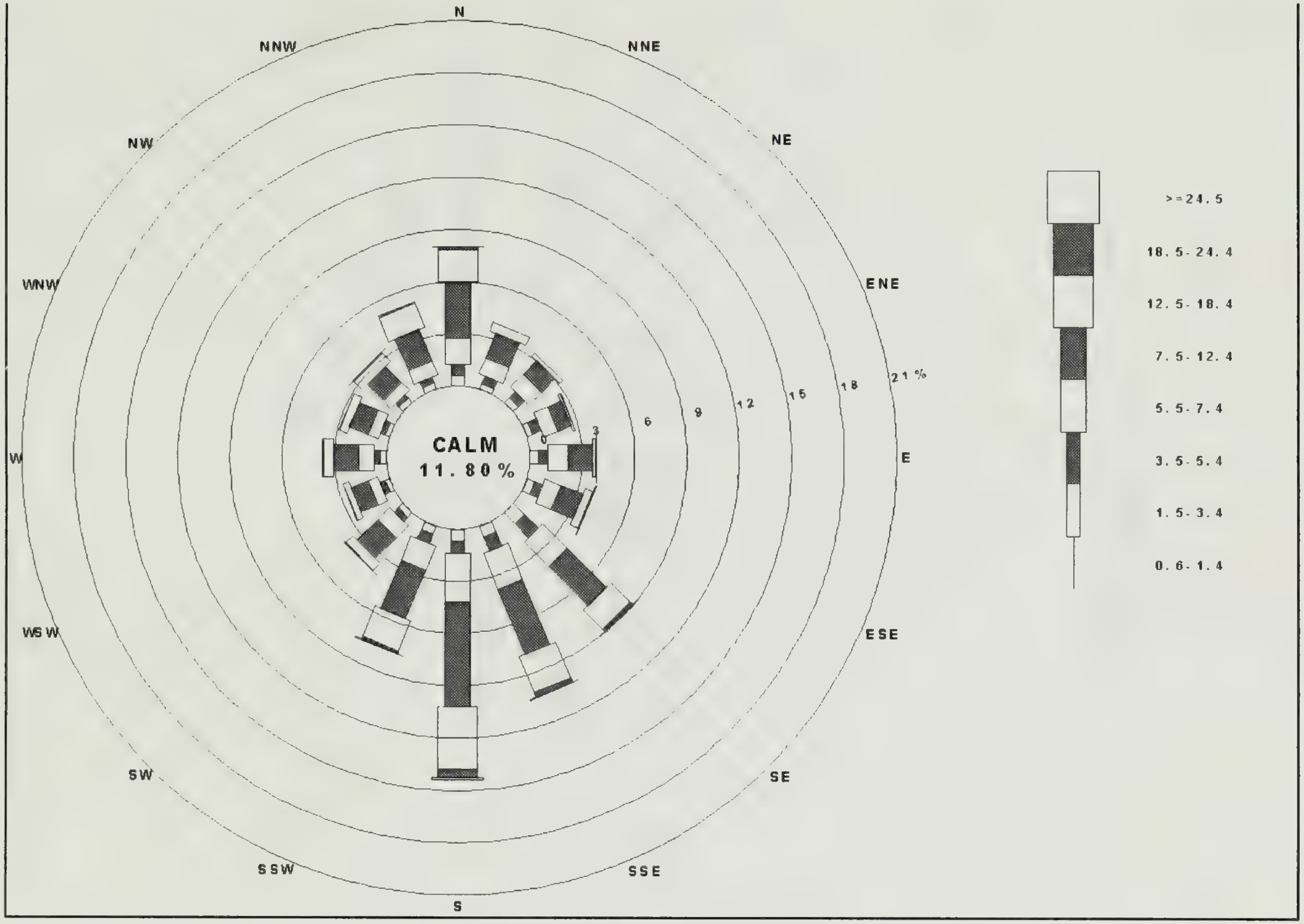


Figure C-1.4 Long-term wind direction and wind speed wind rose for Jackson, Mississippi - Summer 1961-1990 (Jun-Aug).

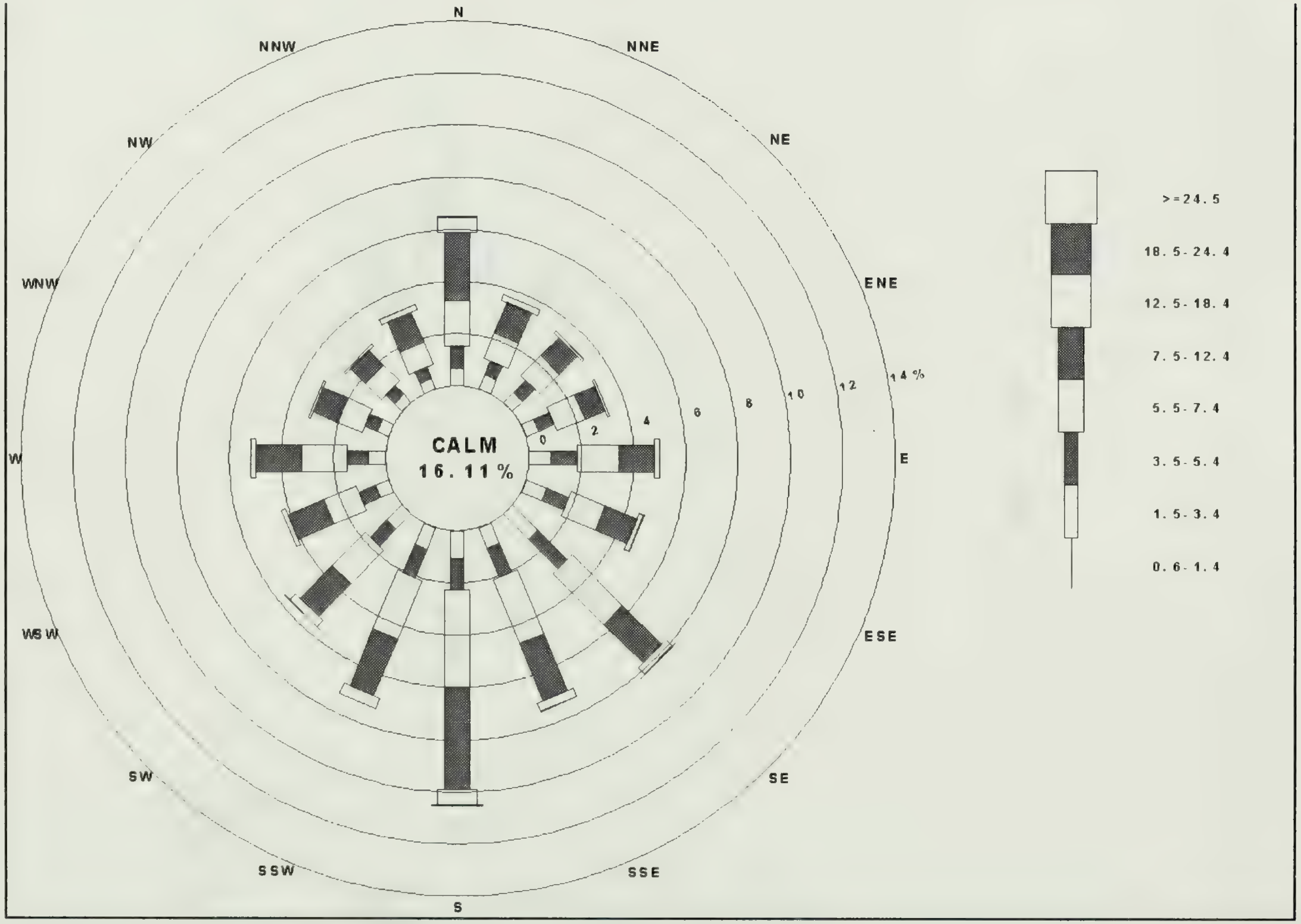
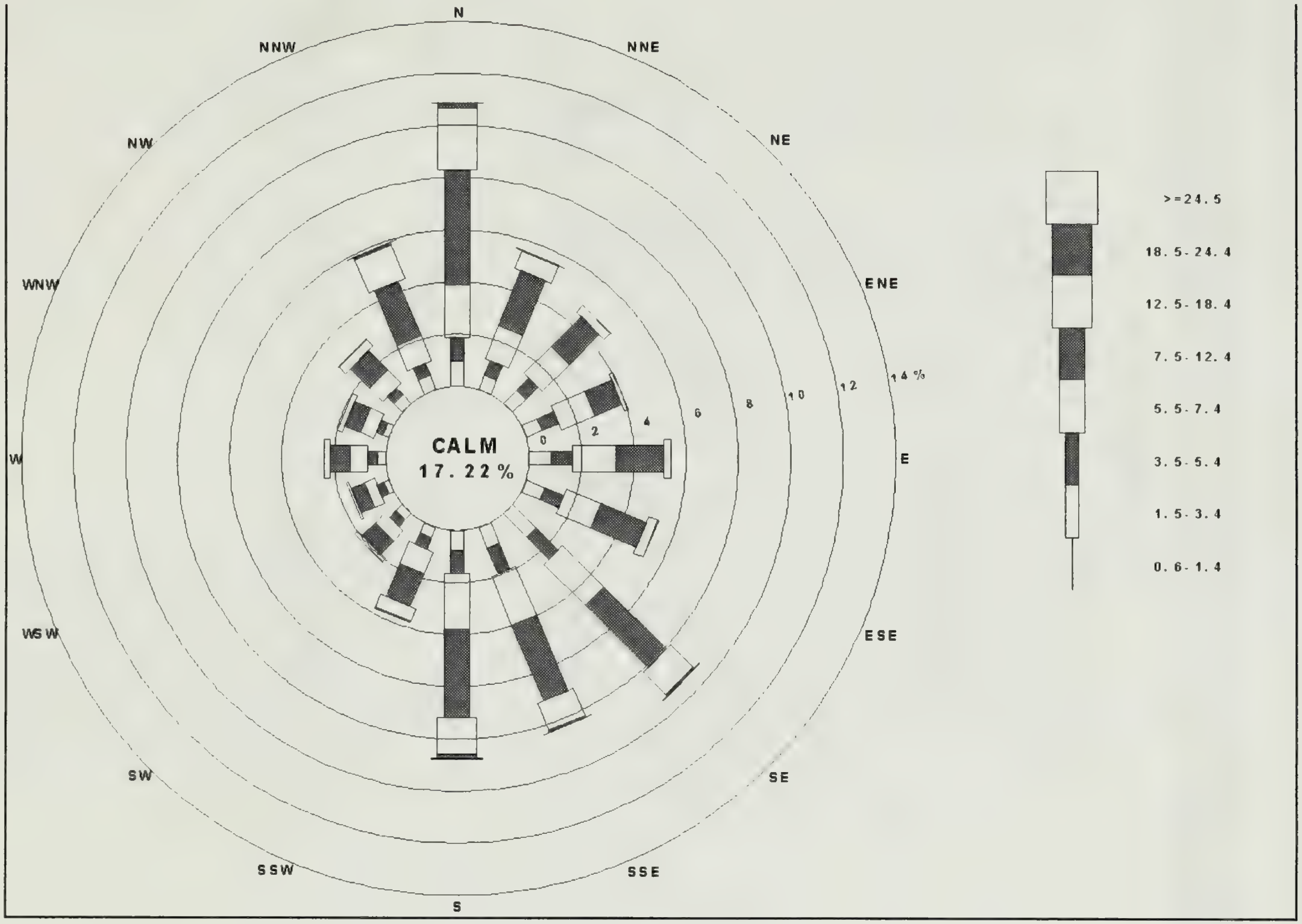
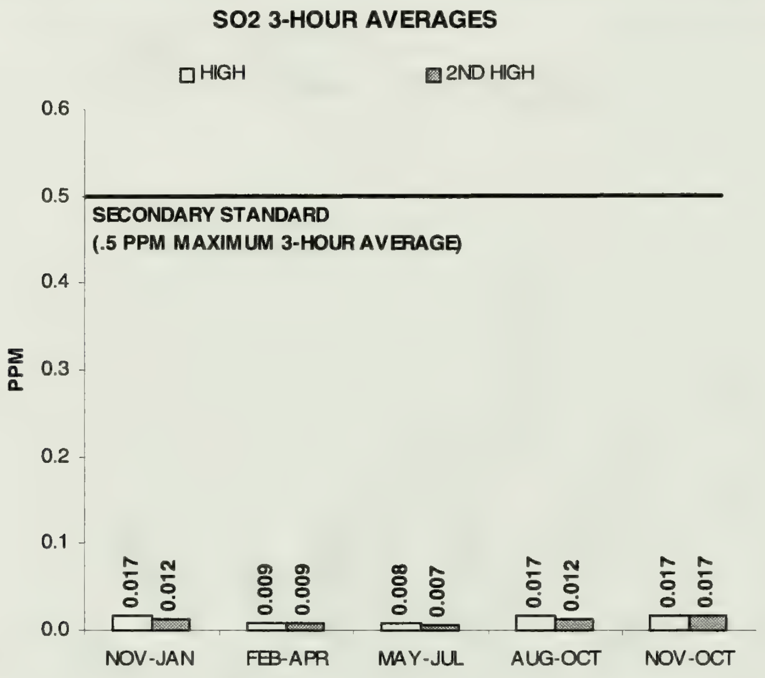


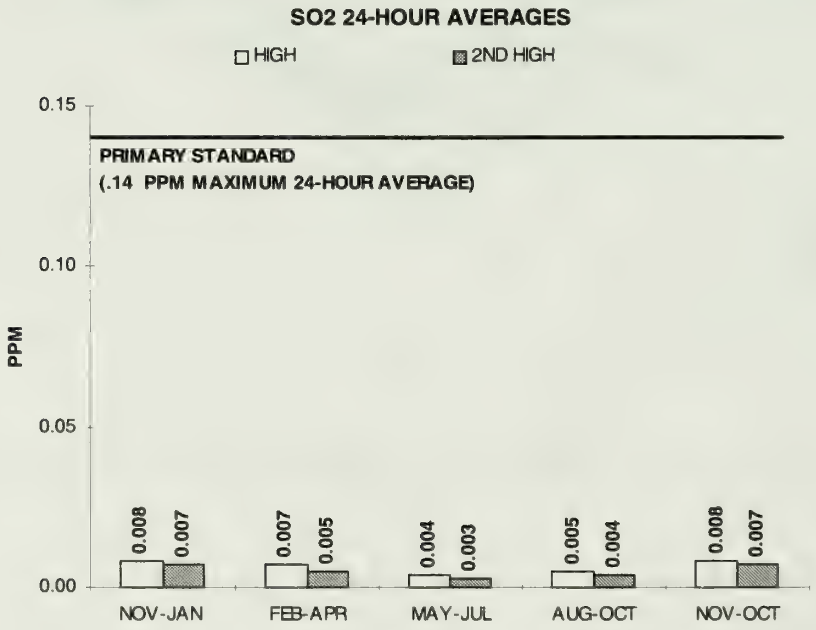
Figure C-1.5 Long-term wind direction and wind speed wind rose for Jackson, Mississippi - Fall 1961-1990 (Sep-Nov).



Appendix C-2 Air Resources - Ambient Concentrations of Criteria Pollutants

Figure C-2.1 Comparison of SO_2 concentration with standard, RHPP PSD site November 1996-October 1997.





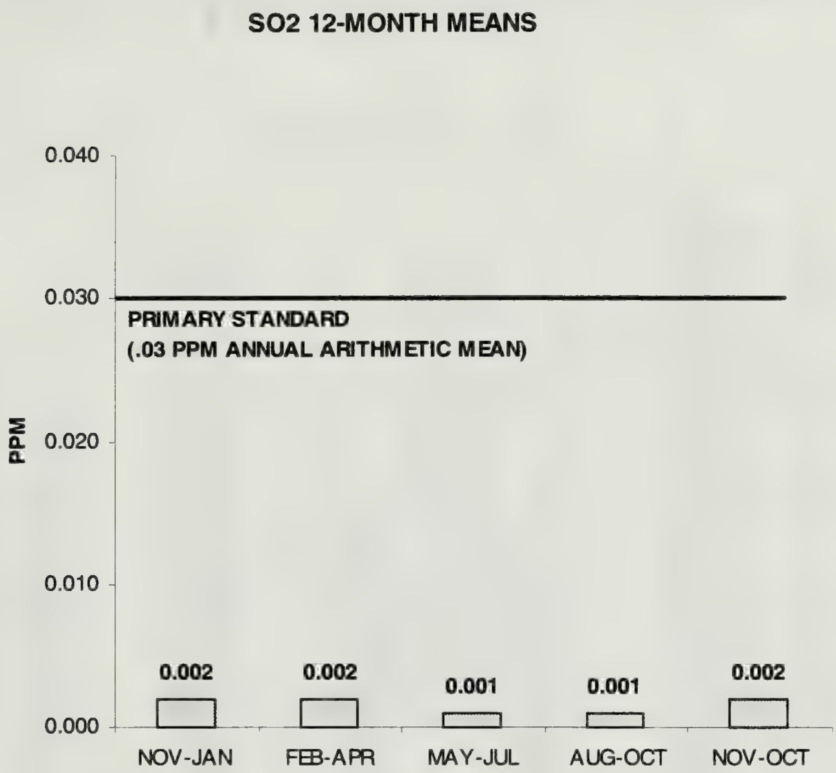
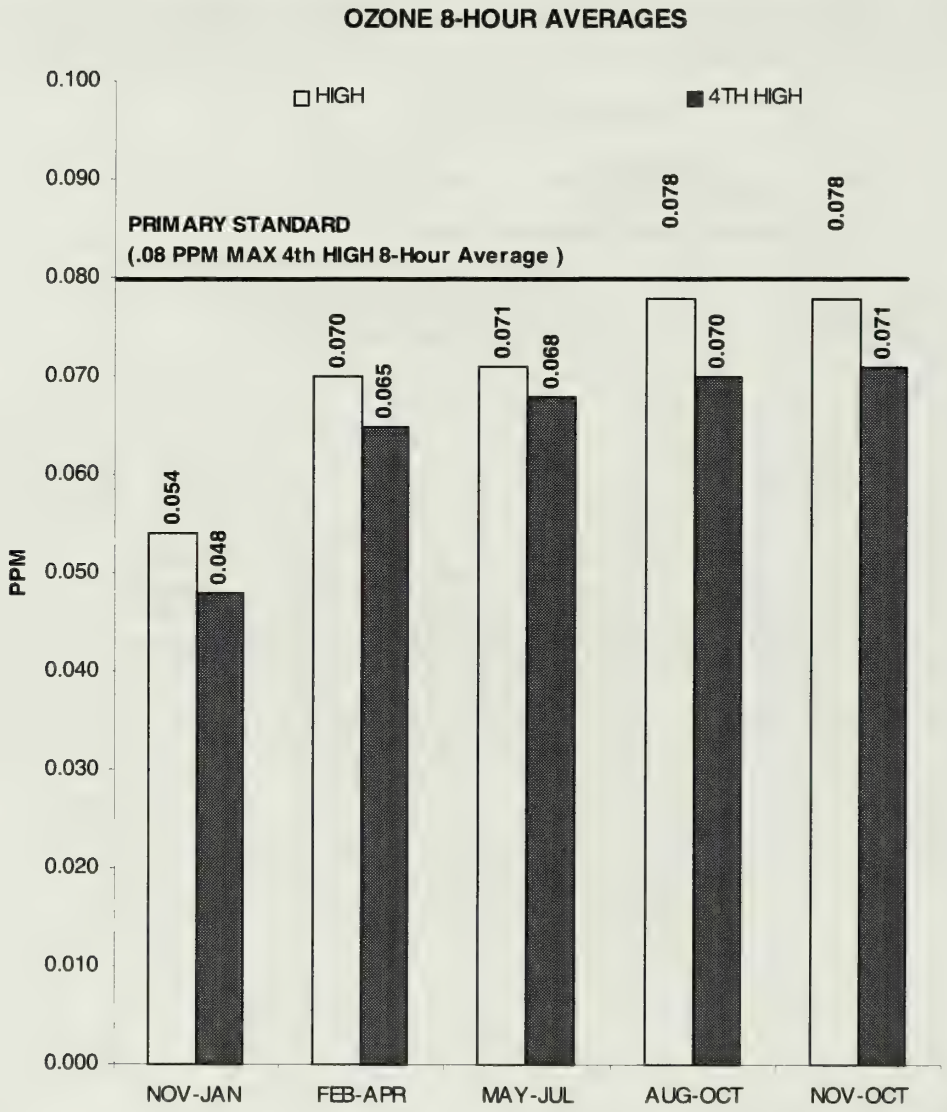

SO2 12-MONTH MEANS
0.040
0.030
0.020
0.010
0.000
PPM
PRIMARY STANDARD
(.03 PPM ANNUAL ARITHMETIC MEAN)
0.002
0.002
0.001
0.001
0.002
NOV-JAN
FEB-APR
MAY-JUL
AUG-OCT
NOV-OCT

Figure C-2.2 Comparison of ozone concentration with standard RHPP PSD site November 1996-October 1997.



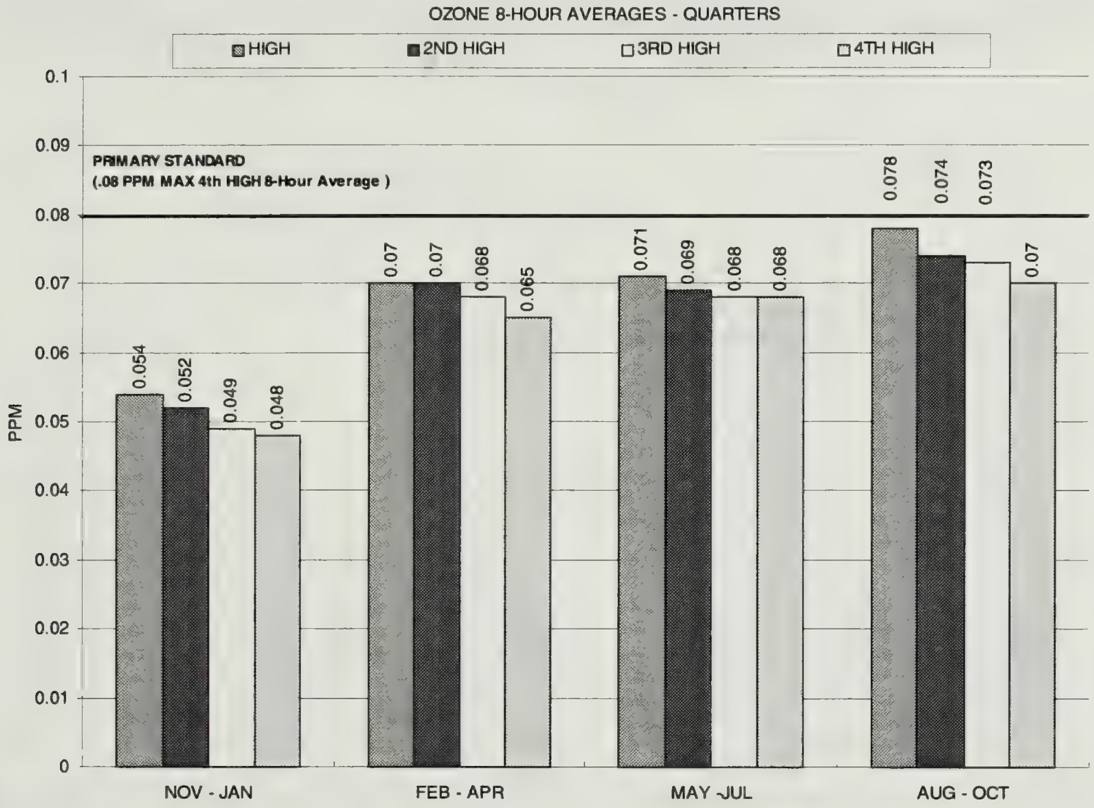


Figure C-2.3 Comparison of NO_2 concentration with standard RHPP PSD site November 1996-October 1997.

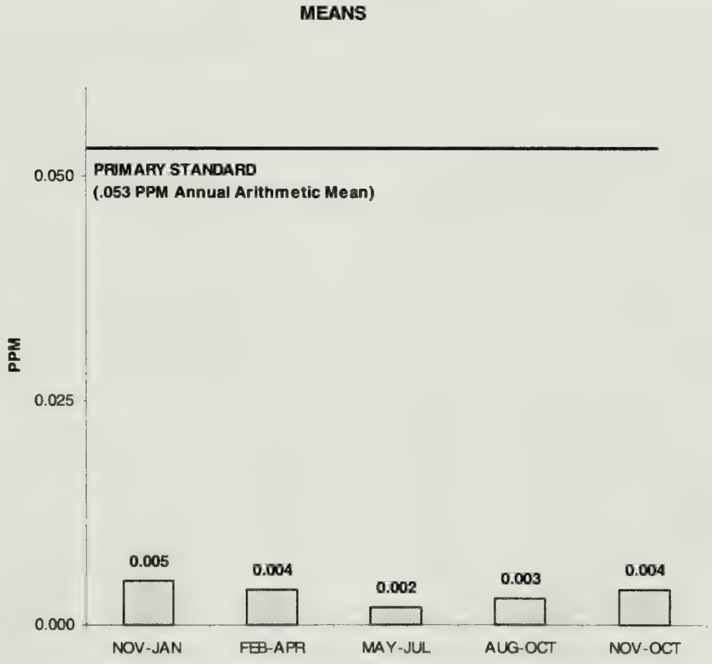


Figure C-2.4 Comparison of lead concentration with standard RHPP PSD site November 1996-October 1997.

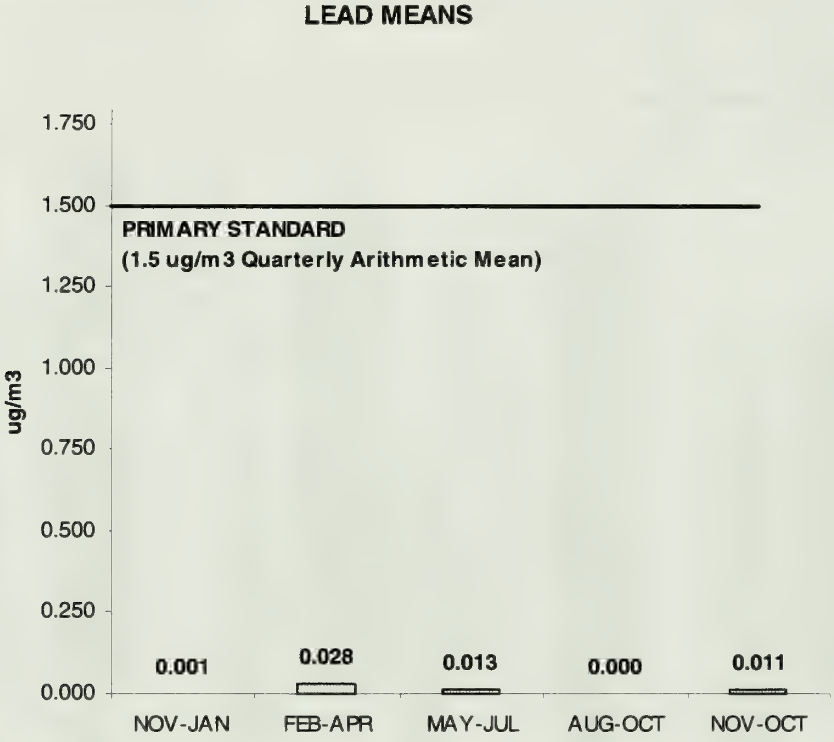
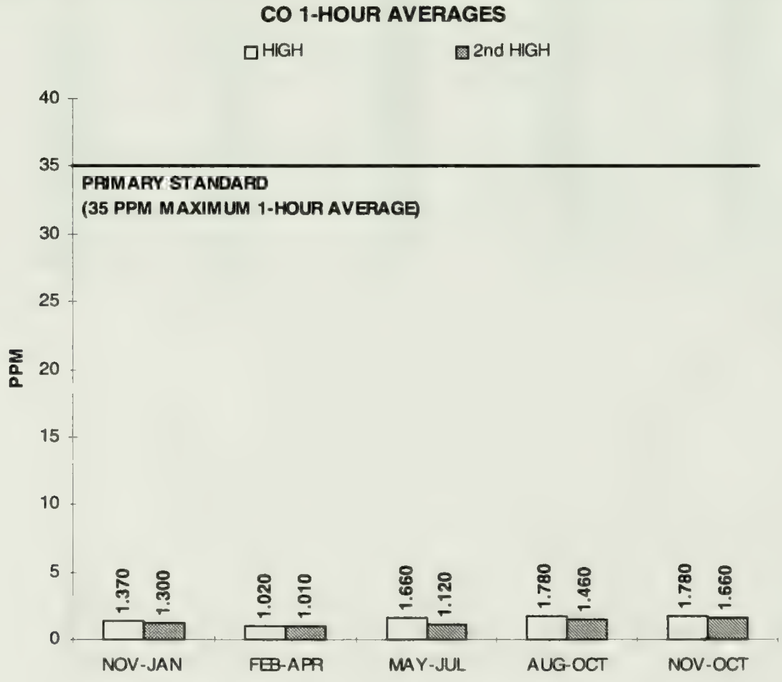


Figure C-2.5 Comparison of CO concentration with standard RHPP PSD site November 1996-October 1997.



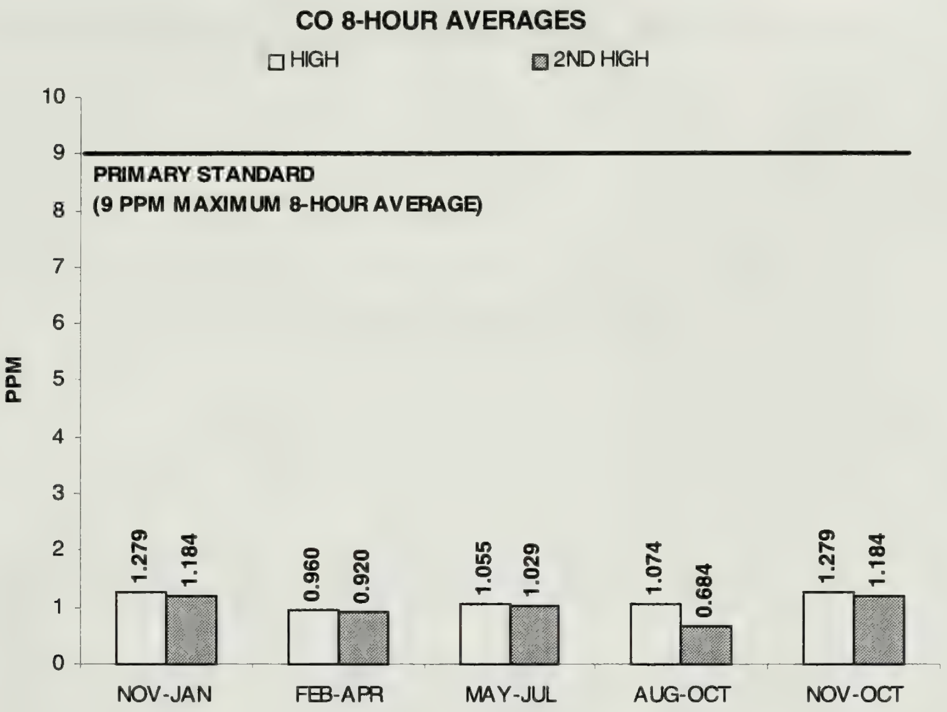
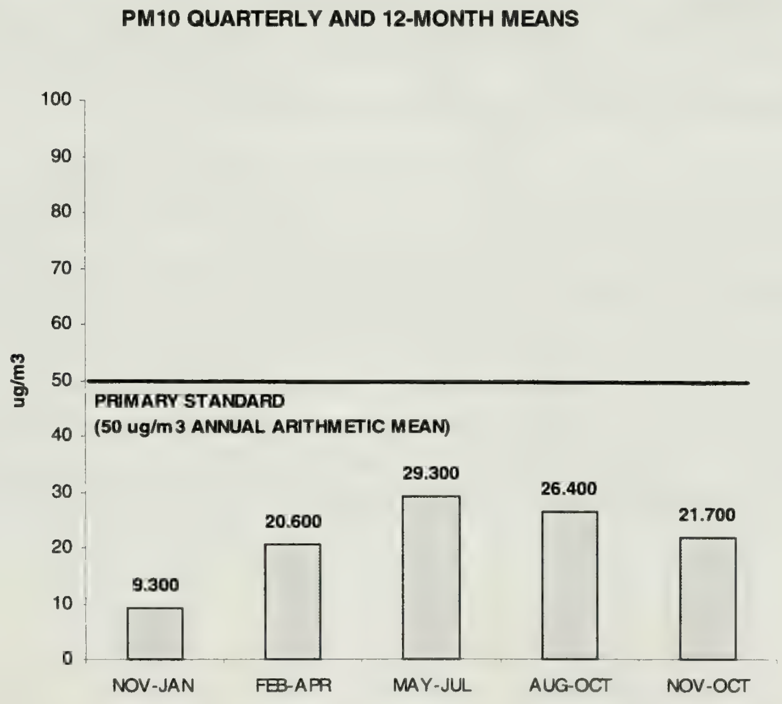
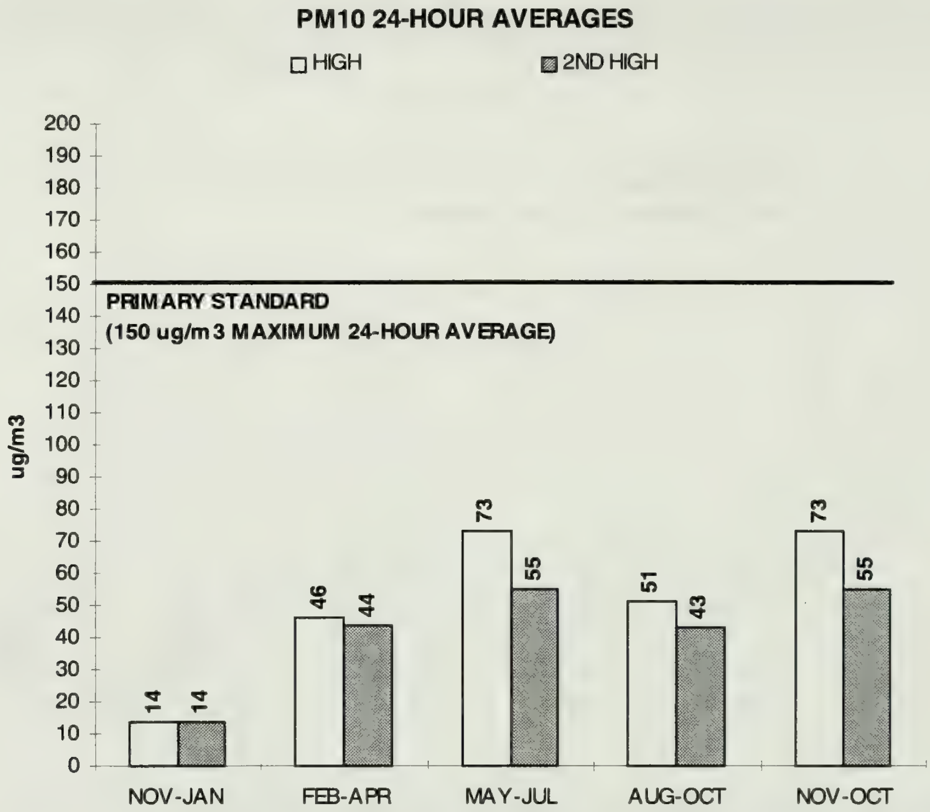


Figure C-2.6 Comparison of PM10 concentration with standard RHPP PSD site November 1996-October 1997.





Appendix C-3 Geology - Seismology

Possible Seismogenic Rift Structures in Mississippi and Alabama

Low-intensity magnetic and negative gravity anomalies in northern Mississippi and western Alabama have been interpreted to represent shallow grabens formed by northwest-southeast extension during Neoproterozoic—early Paleozoic time (Johnson et al. 1994). Johnson et al. (1994) claim that if these potential field anomalies do correspond to structures like that found in the Mississippi Valley graben, and if the area is coupled to the same stress field, then these structures may represent previously unrecognized seismic hazards. However, so few earthquakes have occurred in the vicinity of these inferred rifts that it is difficult to judge whether there is a correlation between earthquakes and these structures. The graben inferred by Johnson et al. (1994) in western Alabama appears to have the closest spatial correlation with known earthquake activity (Figures 3.3.5-3, C-3.1, and C-3.2).

Figure C-3.1 Basement and Paleozoic Faults in Mississippi, Alabama, and Tennessee.

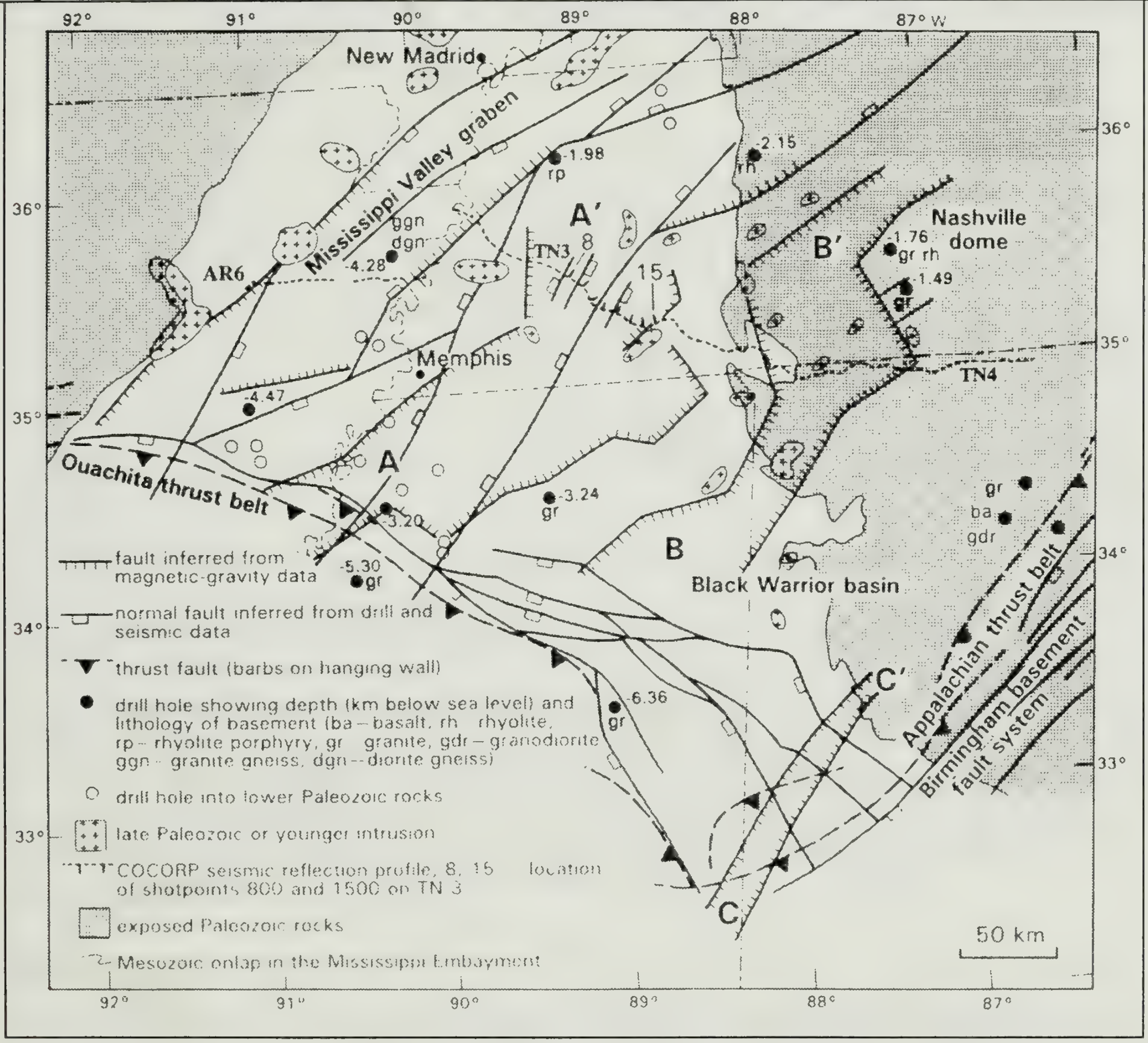
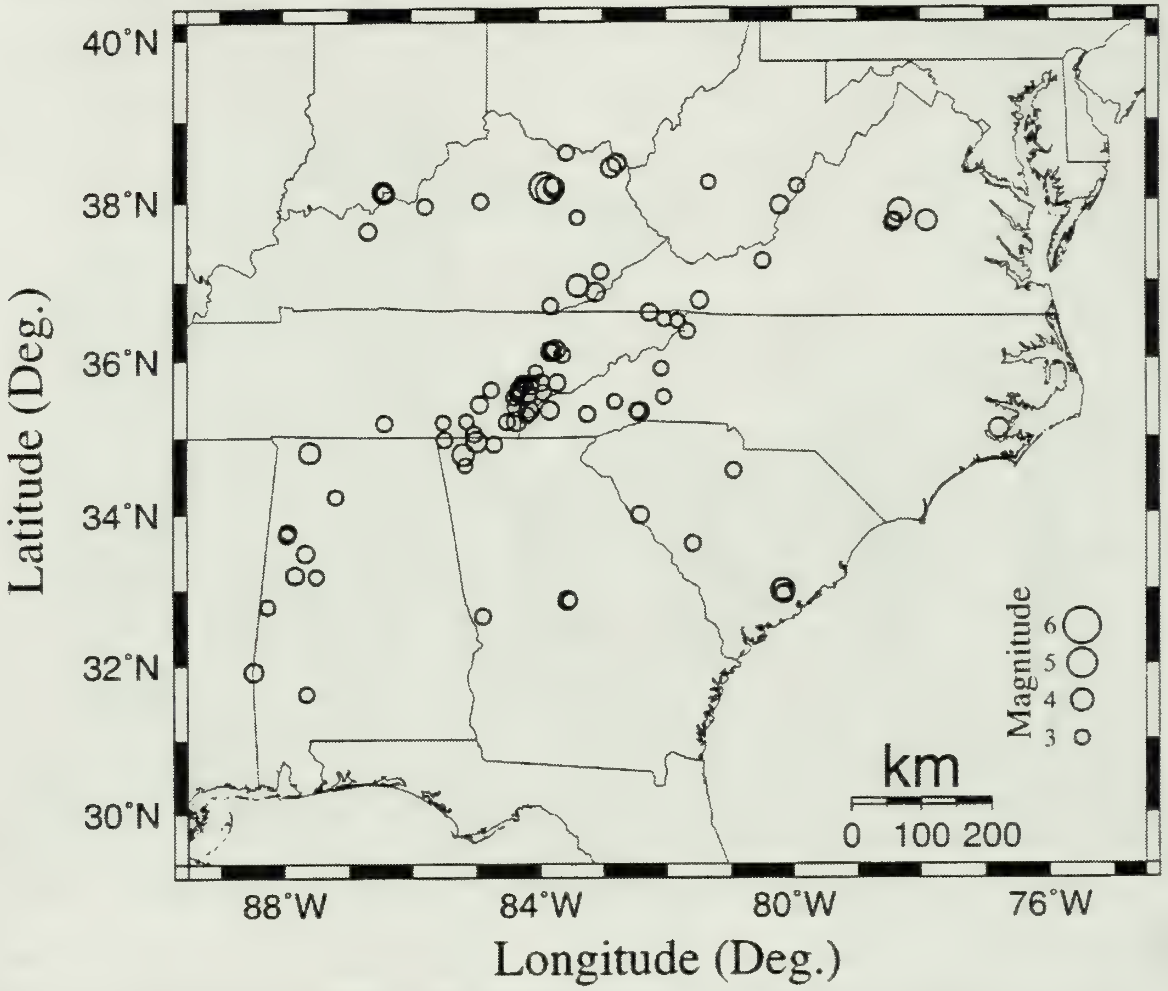


Figure C-3.2 Southeastern United States earthquakes with magnitudes ≥ 3.0 from July 1977 through December 1996.



Appendix C-4 Geology - Significant Earthquakes Near the RHPP Site

The two largest earthquakes listed in Table 3.3.5-1 are the December 17, 1931, magnitude 4.7, earthquake in Yalobusha County, Mississippi, and the February 13, 1886, magnitude 4.0 event in Choctaw County, Alabama. The magnitude estimate for the 1886 earthquake is problematic because, although the maximum Modified Mercalli Intensity for this event was VI or VII (this study), the felt area appears to have been confined to only three counties. The felt area for the 1886 earthquake is estimated to be between 1700 and 33,400 km^2 based on contemporary newspaper accounts. The 1886 earthquake must have occurred at a shallow depth (less than 5 km) considering that it altered land forms along the Tombigbee River, yet was not felt over a wide area (The (Mobile) Daily Register 1886). The closest earthquake to the RHPP site was the November 4, 1977, magnitude 3.4 event in Calhoun County, Mississippi.

Appendix C-5 Geology - Seismic Source Zones

Regional Seismic Source Zones

New Madrid Seismic Zone

The New Madrid Seismic Zone (NMSZ) is located in the central Mississippi Valley within the Reelfoot Rift about 170 miles (275 km) northwest of the RHPP site. The NMSZ has produced damaging earthquakes in historical time including at least three earthquakes estimated to have had m_b magnitudes of 7.6 or greater in the 1811-12 sequence. Johnston and Nava (1985) determined recurrence intervals for NMSZ earthquakes based on historical and instrumental data and concluded that an earthquake of m_b magnitude 6.0 or greater can be expected to occur somewhere within the zone one or more times in 70 years.

A compilation of recent studies related to the NMSZ was published in Seismological Research Letters (1992).

Ouachita — Appalachian Tectonic Belt Junction and Pickens — Gilbertown Fault Zone

Part of the Pickens-Gilbertown Fault Zone coincides with an area of enhanced seismicity in and near Clarke County, Mississippi (Figures 3.3.5-1 and 3.3.5-3). This area of seismic activity also coincides with the intersection of the Ouachita and Appalachian tectonic belts. It is plausible, though not certain, that the junction of these two tectonic belts is related to the increased level of earthquakes in this area. This area has experienced considerable faulting during Cretaceous and early Cenozoic time (Copeland et al. 1976). Earthquakes from this zone and the Southern Appalachian Seismic Zone described below represent important regional sources of earthquakes affecting the RHPP site, exceeded only by earthquakes generated by the NMSZ.

Southern Appalachian Seismic Zone

The Southern Appalachian Seismic Zone (SASZ) stretches from southwestern Virginia to central and western Alabama as defined by Bollinger (1973). The southwestern terminus of the Southern Appalachian Seismic Zone is approximately 80 km (50 miles) east of the RHPP site. The largest earthquake in this zone (estimated magnitude m_b=5.8) occurred in southwestern Virginia in 1897. On October 18, 1916, an earthquake with estimated m_b=5.1 occurred in the southwestern portion of the SASZ near Irondale, Alabama (Reinbold and Johnston 1987). Over the past 20 years, and perhaps longer, seismic activity within the Southern Appalachian Seismic Zone has been concentrated in a band from about 30 miles (50 km) north of Knoxville, Tennessee, southwestward to the Alabama-Georgia border about 38 miles (60 km) south of Chattanooga. This portion of the Southern Appalachian Seismic Zone is called the Eastern Tennessee Seismic Zone (Powell et al. 1994, and Chapman et al. 1997a). The southern end of the Eastern Tennessee Seismic Zone terminates 230 miles (370 km) northeast of the RHPP site.

Wabash Valley Seismic Zone

The Wabash Valley Seismic Zone is an area of moderate seismicity located in southwestern Indiana and southeastern Illinois. This area has produced moderately strong earthquakes in historical times including a magnitude m_b=5.4 event in 1968. Pond and Martin (1997) present paleoliquefaction evidence for four prehistoric earthquakes in the Wabash Valley Seismic Zone with m_b magnitudes ranging from 6.9 to 7.5. These earthquakes are estimated to have occurred from about 4,000 to 12,000 years ago. A compilation of recent research on the Wabash Valley Seismic Zone can be found in Seismological Research Letters (1997). The Wabash Valley Seismic Zone is located about 320 miles (510 km) northwest of the RHPP site.

Charleston, South Carolina Seismic Zone

A zone of earthquakes near Charleston, South Carolina, produced an earthquake with an estimated m_b magnitude of 7.4 near Charleston, South Carolina, in 1886 (Algermissen and Bollinger 1993). Other strong earthquakes are believed to have occurred in the Charleston area in prehistoric time based on paleoliquefaction evidence (Talwani and Cox 1985). The Charleston Seismic Zone is located about 810 kilometers (500 miles) east-southeast of the RHPP site. Additional information on the Charleston Seismic Zone can be found in Nuttli et al. (1986) and Gohn (1983).

Appendix C-6 Geology - Amplification Factors

Table C-6.1 Soil Amplification Factors for NEHRP Categories C and D

Frequency	Category C	Category D
F_A (0.2 seconds Spectral Amplitude)	1.2	1.6
F_V (1.0 second Spectral Amplitude)	1.7	2.4

Appendix C-7 Soils - Project Area Soil Series

Table C-7.1 Physical and Chemical Properties of Soil Series Occurring in Project Area [a)]

Soil Series	Depth (in.)	Clay (%)	Bulk density (g/cm3, moist)	Permeability (in./hr)	Available water capacity (in./in.)	Soil pH	Shrink-swell potential	Erosion Factors K	Erosion Factors T
Ariel	0-47	12-18	1.40-1.50	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.43	5
	47-63	7-27	1.40-1.50	0.2-0.6	0.16-0.20	4.5-5.5	Low	0.43	
Arkabutla	0-7	5-25	1.40-1.50	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.43	5
	7-66	20-35	1.45-1.55	0.6-2.0	0.18-0.21	4.5-5.5	Low	0.32	
Bude	0-20	10-30	1.40-1.55	0.6-2.0	0.18-0.23	4.5-6.0	Low	0.49	3
	20-30	10-32	1.35-1.55	0.06-0.2	0.10-0.12	4.5-6.0	Moderate	0.43	
	30-60	16-32	1.45-1.60	0.06-0.2	0.10-0.12	4.5-6.0	Moderate	0.37	
Cascilla	0-8	5-20	1.40-1.50	0.6-2.0	0.18-0.22	4.5-5.5	Low	0.43	5
	8-65	18-30	1.45-1.50	0.6-2.0	0.16-0.20	4.5-5.5	Low	0.43	
Chenneby	0-9	12-27	1.30-1.60	0.6-2.0	0.14-0.20	4.5-6.0	Low	0.37	5
	9-40	12-35	1.30-1.50	0.6-2.0	0.15-0.20	4.5-6.0	Low	0.32	
	40-60	8-30	1.30-1.50	2.0-6.0	0.05-0.10	4.5-6.0	Low	0.24	
Guyton	0-17	7-25	1.35-1.65	0.6-2.0	0.20-0.23	3.6-6.0	Low	0.43	5
	17-47	20-35	1.35-1.70	0.06-0.2	0.15-0.22	3.6-6.0	Low	0.37	
	47-77	20-35	1.35-1.70	0.06-0.2	0.15-0.22	3.6-8.4	Low	0.37	
Maben	0-5	15-25	1.40-1.50	0.6-2.0	0.15-0.20	5.6-6.5	Low	0.37	3
	5-22	35-55	1.45-1.55	0.2-0.6	0.14-0.18	4.5-6.0	High	0.28	
	22-35	--- [c)]	---	0.2-0.6	0.14-0.18	4.5-6.0	Moderate	0.28	
	35-67	---	---	0.2-0.6	0.10-0.15	4.5-6.0	Low	---	
Oaklimeter	0-7	10-16	1.40-1.50	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.43	5
	7-16	7-18	1.40-1.50	0.6-2.0	0.15-0.20	4.5-5.5	Low	0.43	
	16-60	7-30	1.40-1.50	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.43	
Ora	0-5	10-25	1.45-1.55	2.0-6.0	0.18-0.20	3.6-5.5	Low	0.37	3
	5-22	18-33	1.45-1.60	0.6-2.0	0.12-0.18	3.6-5.5	Low	0.37	
	22-50	18-33	1.70-1.80	0.2-0.6	0.05-0.10	3.6-5.5	Low	0.32	
	50-60	10-35	1.65-1.75	0.6-2.0	0.10-0.15	3.6-5.5	Low	0.37	
Providence	0-5	5-12	1.30-1.40	0.6-2.0	0.20-0.22	4.5-6.0	Low	0.49	3

Table C-7.1 Physical and Chemical Properties of Soil Series Occurring in Project Area [a]

Soil Series	Depth (in.)	Clay (%)	Bulk density (g/cm3, moist)	Permeability (in./hr)	Available water capacity (in./in.)	Soil pH	Shrink-swell potential	Erosion Factors K	T
	5-19	18-30	1.40-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low	0.43	
	19-30	20-30	1.40-1.60	0.2-0.6	0.08-0.10	4.5-6.0	Moderate	0.32	
	30-60	12-25	1.40-1.60	0.2-0.6	0.08-0.10	4.5-6.0	Low	0.32	
Rosebloom	0-9	18-25	1.40-1.55	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.43	5
	9-60	28-35	1.40-1.50	0.6-2.0	0.18-0.22	4.5-5.5	Moderate	0.37	
Ruston	0-6	5-20	1.30-1.70	0.6-2.0	0.09-0.16	4.5-6.5	Low	0.28	5
	6-28	18-35	1.40-1.80	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.28	
	28-37	10-20	1.30-1.70	0.6-2.0	0.12-0.15	4.5-6.0	Low	0.32	
	37-80	15-38	1.40-1.70	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.28	
Smithdale	0-7	2-15	1.40-1.50	2.0-6.0	0.14-0.16	4.5-5.5	Low	0.28	5
	7-47	18-33	1.40-1.55	0.6-2.0	0.15-0.17	4.5-5.5	Low	0.24	
	47-80	12-27	1.40-1.55	2.0-6.0	0.14-0.16	4.5-5.5	Low	0.28	
Sweatman	0-6	5-20	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.37	3
	6-29	35-55	1.40-1.50	0.2-0.6	0.16-0.20	4.5-5.5	Moderate	0.28	
	29-37	35-55	1.40-1.55	0.2-0.6	0.16-0.20	4.5-5.5	Moderate	0.28	
	37-62	---	---	0.2-0.6	0.10-0.18	4.5-5.5	Moderate	---	
Tippah	0-5	5-20	1.35-1.45	0.6-2.0	0.20-0.22	4.5-6.0	Low	0.43	5
	5-28	20-35	1.40-1.50	0.6-2.0	0.19-0.21	4.5-6.0	Moderate	0.43	
	28-60	30-55	1.40-1.55	0.06-0.2	0.16-0.18	4.5-6.0	High	0.24	

[a] Source: USDA-SCS 1986. Soil Survey of Choctaw County, Mississippi.
[b] Defined in: Wischmeier and Smith 1978.
[c] Missing data.

Appendix C-8 Soils - Native Soil in Mine Permit Area

Table C-8.1 Select Physical and Chemical Properties of Native Soil Baseline Analysis in Mine Permit Area [a]

					pH		Sand %		Clay %		CEC meq/100g		Base saturation %		Acid/Base accounting[b]	
Soil Series	Horizon	Minimum depth (in.)	Maximum depth (in.)	Number of samples	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Chenneby	A	0	12	13	5.1	± 0.3	23	± 8	18	± 3	6.7	± 2.5	60	± 11	0.2	± 0.7
	B	4	48	36	5.0	± 0.2	19	± 6	24	± 5	8.9	± 3.5	46	± 12	-1.1	± 1.2
	C	41	48	1	4.9	NA	29	NA	27	NA	7.1	NA	63	NA	-1.3	NA
Oaklimeter	A	0	31	12	5.1	± 0.2	22	± 12	19	± 6	8.2	± 3.1	46	± 15	-0.4	± 0.5
	B	4	48	36	5.1	± 0.2	24	± 11	22	± 4	7.0	± 2.2	39	± 14	-1.0	± 0.8
Ora	A	0	7	10	4.8	± 0.3	43	± 12	16	± 4	4.9	± 3.1	43	± 22	-0.5	± 0.5
	E	4	15	7	4.8	± 0.2	47	± 10	14	± 3	2.6	± 1.5	27	± 13	-0.8	± 0.4
	B	5	48	36	4.9	± 0.2	38	± 13	32	± 8	7.3	± 2.4	37	± 15	-1.6	± 0.5
Providence	A	0	7	10	4.9	± 0.5	31	± 9	18	± 6	6.2	± 3.4	45	± 16	-0.7	± 0.9
	E	3	12	5	5.0	± 0.4	34	± 6	15	± 1	3.1	± 2.3	34	± 21	-0.3	± 0.3
	B	3	48	39	5.0	± 0.2	24	± 9	32	± 4	10.1	± 4.4	40	± 12	-1.7	± 0.9
Smithdale	A	0	13	11	4.9	± 0.3	58	± 12	12	± 2	2.7	± 1.1	44	± 18	-0.4	± 0.4
	E	3	16	7	5.1	± 0.2	62	± 13	12	± 2	2.8	± 1.2	22	± 14	-0.3	± 0.4
	B	7	48	27	4.9	± 0.3	54	± 13	27	± 7	6.7	± 3.0	37	± 19	-1.2	± 0.7
Sweatman	A	0	7	11	5.1	± 0.4	39	± 12	15	± 2	7.6	± 4.1	48	± 11	-0.2	± 0.8
	B	3	43	30	4.8	± 0.3	26	± 8	46	± 7	18.2	± 4.9	62	± 19	-2.6	± 2.1
	C	34	48	10	4.6	± 0.2	28	± 9	40	± 5	18.7	± 3.1	57	± 12	-3.8	± 1.4

[a] Source: Phillips Coal Company; native soil database analyses by Inter-Mountain Laboratories, Inc., College Station, Texas, August 7, 1997, report. Data presented are means of 10 soil profiles for each soil series. Subsamples of B (and some A) horizons were analyzed.

[b] Tons of $CaCO_3$ equilivalent/1000 tons.

Appendix C-9 Soils - Overburden Cores in Mine Permit Area

Table C-9.1 Select Physical and Chemical Analyses of Overburden Cores in Mine Permit Area [a)]

Core sample ID and zone	Sampling depth (ft)	Number of samples	pH Mean	pH SD	Sand % Mean	Sand % SD	Clay % Mean	Clay % SD	CEC meq/100g Mean	CEC meq/100g SD	Base saturation % Mean	Base saturation % SD	Acid/Base accounting[b)] Mean	Acid/Base accounting[b)] SD
3597: Oxidized, upper	0-4.2	2	5.6	± 0.4	26	± 7	23	± 8	9.5	± 2.5	76	± 9	1.5	± 2.0
Oxidized, lower	4.2-12.4	2	7.4	± 0.1	52	± 13	21	± 3		± 1.4	100	± 0	1.5	± 0.7
Unoxidized	12.4-175.0	19	7.1	± 1.3	20	± 25	31	± 10	19.3	± 7.7	95	± 11	9.9	± 16.0
3598: Oxidized, upper	0-4.1	3	4.9	± 0.5	29	± 4	33	± 10	16.9	± 15.8	63	± 14	-1.6	± 1.8
Oxidized, lower	4.1-72.0	7	5.8	± 0.6	64	± 20	17	± 6	16.4	± 7.6	98	± 3	2.7	± 1.7
Unoxidized	72.0-261.8	23	7.3	± 1.0	28	± 26	30	± 11	23.0	± 12.6	96	± 6	6.2	± 18.3
3599: Oxidized, upper	0-4.2	2	4.6	± 0.1	41	± 12	36	± 11	18.4	± 2.0	42	± 6	-5.3	± 0
Oxidized, lower	4.2-70.4	8	5.7	± 0.8	66	± 25	16	± 9	13.0	± 8.5	89	± 22	1.2	± 3.2
Unoxidized	70.4-238.5	20	7.4	± 1.0	20	± 18	28	± 9	20.1	± 6.9	99	± 5	13.1	± 22.7
3600: Oxidized, upper	0-3.3	2	4.7	± 0.2	8	± 1	40	± 6	22.0	± 14.2	74	± 20	-1.9	± 0.7
Oxidized, lower	3.3-18.4	4	7.2	± 1.1	18	± 9	34	± 11	23.5	± 4.7	100	± 0	16.5	± 15.0
Unoxidized	18.4-180.5	20	7.2	± 0.8	15	± 15	34	± 11	23.5	± 10.2	97	± 5	10.0	± 13.5
3601: Oxidized, upper	0-4.0	1	4.7	NA	10	NA	57	NA	30.5	NA	44	NA	-3.9	± NA
Oxidized, lower	4.0-10.9	2	4.7	± 0.2	29	± 29	38	± 21	25.7	± 8.9	59	± 8	-2.3	± 2.9
Unoxidized	10.9-167.3	20	7.4	± 0.6	24	± 23	33	± 11	25.1	± 12.2	95	± 9	12.0	± 12.9
3603: Oxidized, upper	0-5.0	2	4.6	± 0.1	39	± 24	40	± 21	23.7	± 8.1	35	± 4	-4.4	± 0.9
Oxidized, lower	5.0-30.6	3	5.0	± 0.4	29	± 10	28	± 8	21.7	± 0.8	86	± 10	0.5	± 2.1
Unoxidized	30.6-218.0	21	7.5	± 0.5	23	± 19	31	± 11	23.9	± 9.7	95	± 6	10.5	± 11.0
3605: Oxidized, upper	0-3.6	1	4.9	NA	50	NA	19	NA	7.2	NA	32	NA	-1.1	NA
Oxidized, lower	3.6-11.8	2	5.4	± 0.2	69	± 2	15	± 0	4.8	± 0.6	63	± 6	1.0	± 0.8
Unoxidized	11.8-146.0	16	7.3	± 0.9	37	± 23	26	± 10	22.5	± 9.2	93	± 10	10.7	± 12.8
3607: Oxidized, upper	0-4.5	2	4.8	± 0.1	24	± 0	24	± 0	10.3	± 0.1	27	± 1	-1.7	± 0.3
Oxidized, lower	4.5-14.5	1	5.6	NA	35	NA	24	NA	13.0	NA	81	NA	1.6	NA
Unoxidized	14.5-113.4	12	6.7	± 1.3	26	± 20	27	± 8	24.8	± 9.4	87	± 14	6.4	± 21.1
3609: Oxidized, upper	0-3.6	2	5.0	± 0.7	17	± 4	41	± 20	26.1	± 18.3	64	± 3	-3.0	± 4.2
Oxidized, lower	3.6-29.0	3	5.7	± 0.5	56	± 20	17	± 5	18.5	± 4.1	94	± 4	4.0	± 1.8
Unoxidized	29.0-192.3	22	7.3	± 0.7	15	± 14	36	± 7	25.8	± 8.6	91	± 10	12.6	± 11.9
3612: Oxidized, upper	0-3.1	2	4.4	± 0	40	± 13	38	± 10	12.3	± 0.6	57	± 15	-2.7	± 0.8
Oxidized, lower	3.1-9.2	2	4.1	± 0.2	21	± 10	32	± 11	21.8	± 0.7	78	± 10	-2.4	± 1.0

Table C-9.1 Select Physical and Chemical Analyses of Overburden Cores in Mine Permit Area [a)]

Core sample ID and zone	Sampling depth (ft)	Number of samples	pH Mean		pH SD	Sand % Mean		Sand % SD	Clay % Mean		Clay % SD	CEC meq/100g Mean		CEC meq/100g SD	Base saturation % Mean		Base saturation % SD	Acid/Base accounting[b)] Mean		Acid/Base accounting[b)] SD
Unoxidized	9.2-205.5	22	7.1	±	0.7	22	±	20	29	±	10	24.9	±	9.9	89	±	8	10.7	±	11.6
3613: Oxidized, upper	0-4.5	2	4.5	±	0.1	30	±	11	28	±	4	6.2	±	0.9	44	±	13	-1.7	±	0.1
Oxidized, lower	4.5-12.4	1	4.6		NA	22		NA	30		NA	17.3		NA	75		NA	-1.4		NA
Unoxidized	12.4-209.0	24	7.2	±	1.0	14	±	11	30	±	8	26.8	±	8.1	91	±	9	16.0	±	16.5
3614 Oxidized, upper	0-5.3	2	4.7	±	0.2	25	±	20	37	±	24	14.4	±	12.4	67	±	2	-2.3	±	2.6
Oxidized, lower	5.3-12.0	1	4.5		NA	34		NA	31		NA	16.1		NA	78		NA	-0.4		NA
Unoxidized	12.0-189.0	22	7.0	±	1.1	20	±	19	32	±	10	24.0	±	9.3	88	±	9	9.7	±	21.0

[a)] Source: Phillips Coal Company; overburden core analyses by Inter-Mountain Laboratories, Inc., College Station, Texas; August 22, 1997 report.
[b)] Tons of $CaCO_3$ equilivalent/1000 tons

Appendix C-10 Soils - Overburden Cores in Mine Permit Area

Table C-10.1 Heavy Metal and Pyritic Sulfur Concentrations in Overburden Cores in Mine Permit Area [a)]

Core sample ID and zone	Sampling depth, ft.	Number of samples	Total Arsenic (ppm) Mean	Total Arsenic (ppm) ±SD	Total Cadmium (ppm) Mean	Total Cadmium (ppm) ±SD	Total Chromium (ppm) Mean	Total Chromium (ppm) ±SD	Total Copper (ppm) Mean	Total Copper (ppm) ±SD	Total Lead (ppm) Mean	Total Lead (ppm) ±SD	Total Manganese (ppm) Mean	Total Manganese (ppm) ±SD	Total Nickel (ppm) Mean	Total Nickel (ppm) ±SD	Total Selenium (ppm) Mean	Total Selenium (ppm) ±SD	Total Zinc, (ppm) Mean	Total Zinc, (ppm) ±SD	Pyritic Sulfur, % Mean	Pyritic Sulfur, % ±SD
3597: Oxidized, upper	0-4.2	2	5.6	0.8	0.0	0.0	30	10	12	2	14	1	630	202	10	5	0.6	0.3	53	11	0.00	0.00
Oxidized, lower	4.2-12.4	2	3.2	0.8	0.0	0.0	24	7	7	2	10	2	168	78	10	3	0.1	0.1	52	1	0.00	0.00
Unoxidized	12.4-175.0	19	6.4	3.2	0.2	0.1	52	17	20	9	15	5	355	225	26	11	0.9	0.6	77	24	0.10	0.24
3598: Oxidized, upper	0-4.1	3	8.2	3.9	0.0	0.0	43	10	11	3	13	0	92	50	14	3	0.4	0.2	62	24	0.00	0.00
Oxidized, lower	4.1-72.0	7	3.4	1.6	1.0	1.8	28	12	7	5	11	2	184	147	17	4	0.0	0.0	45	17	0.00	0.00
Unoxidized	72.0-261.8	23	5.3	1.8	0.2	0.2	48	15	21	14	14	4	298	194	25	9	1.1	1.3	71	22	0.26	0.40
3599: Oxidized, upper	0-4.2	2	6.9	1.3	0.0	0.0	42	5	10	1	14	0	65	13	14	4	1.1	0.8	128	119	0.00	0.00
Oxidized, lower	4.2-70.4	8	3.7	2.4	0.1	0.1	27	13	10	11	11	3	131	132	12	8	0.1	0.2	49	39	0.00	0.00
Unoxidized	70.4-238.5	20	6.4	1.9	0.2	0.1	58	12	20	12	13	4	380	183	29	10	0.9	0.8	84	21	0.17	0.26
3600: Oxidized, upper	0-3.3	2	9.1	0.7	0.0	0.0	61	14	28	16	17	4	92	42	23	4	1.8	0.8	68	19	0.00	0.00
Oxidized, lower	3.3-18.4	4	5.9	0.7	0.2	0.2	63	8	21	2	13	1	356	293	35	7	0.4	0.3	94	10	0.00	0.00
Unoxidized	18.4-180.5	20	6.4	2.3	0.3	0.1	65	12	28	16	15	3	357	304	28	10	1.4	1.3	89	21	0.16	0.28
3601: Oxidized, upper	0-4.0	1	8.6	NA	0.0	NA	72	NA	16	NA	14	NA	71	NA	17	NA	0.9	NA	52	NA	0.00	NA
Oxidized, lower	4.0-10.9	2	7.4	3.3	0.0	0.0	57	16	15	4	19	6	275	308	14	1	0.4	0.3	54	0	0.00	0.00
Unoxidized	10.9-167.3	20	5.4	2.3	0.3	0.2	70	31	29	18	17	8	495	501	33	21	1.7	1.8	95	47	0.12	0.10
3603: Oxidized, upper	0-5.0	2	5.9	3.7	0.1	0.1	66	11	18	8	12	0	425	424	22	5	0.6	0.1	96	33	0.00	0.00
Oxidized, lower	5.0-30.6	3	5.8	0.5	0.1	0.1	75	29	13	2	11	2	353	261	21	2	0.3	0.1	84	22	0.00	0.00
Unoxidized	30.6-218.0	21	4.9	1.8	0.2	0.1	66	14	24	11	13	3	378	233	28	8	1.1	1.0	85	23	0.13	0.15
3605: Oxidized, upper	0-3.6	1	2.9	NA	0.0	NA	28	NA	8	NA	7	NA	173	NA	8	NA	0.2	NA	33	NA	0.00	NA
Oxidized, lower	3.6-11.8	2	2.6	0.4	0.0	0.0	23	2	7	1	8	1	268	127	7	0	0.1	0.1	41	15	0.00	0.00
Unoxidized	11.8-146.0	16	4.4	1.9	0.2	0.2	60	18	18	9	14	4	400	200	25	9	0.9	0.9	80	25	0.07	0.14
3607: Oxidized, upper	0-4.5	2	3.8	0.1	0.0	0.0	46	1	12	1	16	1	660	147	13	1	0.4	0.0	73	35	0.00	0.00

Table C-10.1 Heavy Metal and Pyritic Sulfur Concentrations in Overburden Cores in Mine Permit Area [a)]

Core sample ID and zone	Sampling depth, ft.	Number of samples	Total Arsenic (ppm)		Total Cadmium (ppm)		Total Chromium (ppm)		Total Copper (ppm)		Total Lead (ppm)		Total Manganese (ppm)		Total Nickel (ppm)		Total Selenium (ppm)		Total Zinc, (ppm)		Pyritic Sulfur, %	
			Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD
Oxidized, lower	4.5-14.5	1	3.7	NA	0.0	NA	46	NA	11	NA	10	NA	272	NA	16	NA	0.2	NA	48	NA	0.00	NA
Unoxidized	14.5-113.4	12	4.3	2.3	0.2	0.1	55	13	20	10	16	4	378	239	27	10	0.9	0.9	79	24	0.21	0.38
3609: Oxidized, upper	0-3.6	2	6.0	0.4	0.1	0.1	56	8	14	4	16	4	511	617	21	2	0.3	0.1	54	12	0.00	0.00
Oxidized, lower	3.6-29.0	3	3.5	0.7	0.1	0.1	41	6	7	3	12	3	446	170	23	7	0.0	0.0	67	12	0.00	0.00
Unoxidized	29.0-192.3	22	3.7	0.9	0.3	0.1	59	8	27	10	17	3	412	233	34	9	1.0	0.8	99	20	0.09	0.12
3612: Oxidized, upper	0-3.1	2	3.2	0.6	0.0	0.0	53	13	21	1	16	1	60	5	18	1	0.8	0.1	71	16	0.00	0.00
Oxidized, lower	3.1-9.2	2	2.1	0.9	0.0	0.0	56	1	19	11	17	1	115	74	21	4	0.4	0.1	74	1	0.00	0.00
Unoxidized	9.2-205.5	22	3.4	1.2	0.2	0.1	71	16	25	13	16	4	650	870	32	9	1.5	1.3	95	23	0.11	0.16
3613: Oxidized, upper	0-4.5	2	2.5	3.5	0.1	0.1	53	8	12	3	16	5	109	47	12	1	0.7	0.1	55	20	0.00	0.00
Oxidized, lower	4.5-12.4	1	5.0	NA	0.0	NA	65	NA	13	NA	20	NA	693	NA	26	NA	0.7	NA	83	NA	0.00	NA
Unoxidized	12.4-209.0	24	4.1	1.5	0.3	0.1	73	11	24	8	15	3	479	344	35	8	1.4	1.4	99	19	0.09	0.19
3614 Oxidized, upper	0-5.3	2	5.1	0.5	0.0	0.0	74	19	20	17	15	4	152	107	20	10	0.3	0.4	66	7	0.00	0.00
Oxidized, lower	5.3-12.0	1	4.1	NA	0.0	NA	66	NA	22	NA	17	NA	395	NA	27	NA	0.5	NA	77	NA	0.00	NA
Unoxidized	12.0-189.0	22	3.7	1.5	0.2	0.2	78	18	23	12	14	3	611	472	37	12	1.0	0.9	105	26	0.17	0.26

[a)] Source: Phillips Coal Company; overburden core analyses by Inter-Mountain Laboratories, Inc., College Station, Texas; August 22, 1997, report.

Appendix Ç-11 Soils - Capability and Productivity in Project Area

Table C-11.1 Land Capability and Crop and Pasture Productivity of Soils in Project Area[a)]

Soil series; Map symbol	Land capability	Corn (Bu/ac)	Cotton lint (Lbs/ac)	Soybeans (Bu/ac)	Wheat (Bu/ac)	Common bermudagrass (AUM/ac)[b)]	Tall fescue (AUM/ac)[b)]
Ariel; Ae	IIw	110	800	40	35	9.0	10.0
Arkabutla; Ak	IIw	95	700	35	35	7.0	10.0
Bude; Bu	IIw	85	625	25	25	6.5	7.5
Cascilla; Ca	IIw	110	850	40	35	9.0	10.0
Chenneby; Ce	IIw	100	700	35	30	7.0	10.0
Guyton; Gu	IVw	---	---	---	---	6.5	6.0
Maben; MaC	IIIe	---	---	20	25	4.5	7.5
Oaklimeter; Oa	IIw	95	750	40	35	9.0	10.0
Ora; OrC2	IIIe	70	600	30	30	5.0	7.5
Ora; OrD2	IVe	---	---	25	30	4.5	7.0
Providence; PoB2	IIe	80	700	35	30	7.5	8.5
Providence; PoC2	IIIe	70	650	30	25	7.0	7.5
Rosebloom; Ro	IIIw	---	---	30	25	---	8.0
Smithdale-Ruston; SR	VIIe; IIIe	---	---	---	---	---	---
Smithdale-Sweatman; SS	VIIe	---	---	---	---	---	---
Sweatman; SwC	IVe	---	---	---	30	4.0	---
Sweatman; SwE	VIIe	---	---	---	---	3.5	---
Sweatman; SwF	VIIe	---	---	---	---	---	---
Sweatman-Providence; Sx	VIIe; VIe	---	---	---	---	---	---
Tippah; TaB2	IIe	80	650	35	35	7.5	8.5
Tippah; TaC2	IIIe	70	600	30	30	7.0	7.5

a) Source: USDA-SCS. Soil Surveys of Choctaw (1986) and Webster (1978) Counties - Yields are those that can be expected under a high level of management. Absence of yield data indicates that soil is not suited for that crop.

b) AUM = Animal-unit-month: The amount of forage or feed required to feed one animal unit for a period of 30 days.

Appendix C-12 Soils - Forest Suitability and Potential Productivity of Soils in Project Area[a)]

The potential suitability and productivity of the various soils for forest production are determined by two important ratings given in the table: suitability group (ordination symbol) and site index. The suitability group has three components to the symbol. The first part is a numerical rating ranging from 1 through 5, with 1 representing very high productivity and 5 representing low productivity. The second part of the symbol is a letter indicating the major kind of soil limitation. The letter *w* indicates excessive water in or on the soil, *c* indicates presence of clay, and *o* indicates that limitations are insignificant. The third part of the symbol indicates the degree of hazard or limitation and the general suitability of the soils for certain kinds of trees. Soils with numbers of 1 through 3 are best suited to needleleaf trees, a symbol of 4 through 6 indicates best suitability to broadleaf trees, and those with numbers 7 through 9 are suited to both tree types. The site index is a rating of the potential productivity of merchantable trees on a soil. This index is the average height, in feet, that dominant and codominant trees of a given species attained in a specified number of years, usually 50 (USDA-SCS 1986). The index applies to fully stocked, even-aged, unmanaged stands.

Table C-12.1 Forest Suitability and Potential Productivity of Soils in Project Area[a)]

Soil series; Map symbol(s)	Suitability group	Management concerns			Potential productivity	
		Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index
Ariel; Ae	1o7	Slight	Slight	Moderate	Eastern cottonwood	115
					Cherrybark oak; Yellow poplar	110
					Water oak	105
					Sweetgum	100
					Loblolly pine	95
Arkabutla; Ak	1w8	Moderate	Slight	Moderate	Eastern cottonwood; Nuttall oak	110
					Cherrybark oak	105
					Loblolly pine; Sweetgum	100
					Water oak; Willow oak	100
					Green ash	95
Bude; Bu	2w8	Moderate	Slight	Moderate	Cherrybark oak; Loblolly pine; Sweetgum	90
Cascilla; Ca	1o7	Slight	Slight	Moderate	Yellow poplar; Nuttall oak	114-115
					Eastern cottonwood; Cherrybark oak	110-112
					Sweetgum; Water oak	102-104
					Loblolly pine	93
Chenneby; Ce	1w8	Moderate	Moderate	Severe	Yellow poplar; American sycamore	110
					Loblolly pine; Sweetgum; Water oak	100
Guyton; Gu	2w9	Severe	Moderate	Severe	Loblolly pine; Slash pine	90
Maben; MaC	3c2	Moderate	Moderate	Slight	Loblolly pine	83
					Shortleaf pine	73
Oaklimeter; Oa	1o7	Slight	Slight	Moderate	Cherrybark oak; Nuttall oak	100
					Willow oak; Eastern cottonwood;	100
					Sweetgum	100
					Green ash; Loblolly pine	90
Ora; OrC2, OrD2	3o7	Slight	Slight	Moderate	Loblolly pine; Sweetgum	80-83
					Shortleaf pine	69
Providence; PoB2, PoC2	3o7	Slight	Slight	Slight	Sweetgum	90
					Loblolly pine	84
					Shortleaf pine	64

Table C-12.1 Forest Suitability and Potential Productivity of Soils in Project Area[a)]

Soil series; Map symbol(s)	Suitability group	Management concerns			Potential productivity	
		Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index
Rosebloom; Ro	2w9	Severe	Moderate	Moderate	Eastern cottonwood	100
					Green ash; Cherrybark oak	95
					Nuttall oak; Water oak; Sweetgum	95
					Willow oak	90
					American sycamore	80
Smithdale-Ruston; SR	3o1	Slight	Slight	Moderate	Loblolly pine	80-84
					Shortleaf pine	69-75
Smithdale-Sweatman; SS	3o1,3c2	Slight-moderate	Slight	Slight-moderate	Loblolly pine	80-83
					Shortleaf pine	69-73
Sweatman; SwC, SwE, SwF	3c2	Moderate	Slight	Slight	Loblolly pine	83
					Shortleaf pine	73
Sweatman-Providence; Sx	3c2,3o7	Slight-moderate	Slight	Slight	Sweetgum	90
					Loblolly pine	83-84
					Shortleaf pine	64-73
Tippah; TaB2, TaC2	3o7	Slight	Slight	Moderate	Cherrybark oak; Shumard oak	95
					Sweetgum; Yellow poplar	90
					Loblolly pine; White oak	78-80

[a)] Source: USDA-SCS. 1986. Soil Survey of Choctaw County

Appendix C-13 Groundwater Resources - Quality Data

Table C-13.1 Summary of Groundwater and Spring Water Quality Data

Parameter	Units	Tuscaloosa Aquifer System Test Hole 1 (n=4)			Wilcox Aquifer Site Test Wells (n=34 to 43)			Wilcox Springs (n=50)			EPA	MCL Exceedences		
		mean	min	max	mean	min	max	mean	min	max	MCL*	TAS	Wilcox Aquifer	Springs
Acidity	mg/L	<1	<1	<1	<1	<1	<1	22	2	100				
Alkalinity (as CaCO3)	mg/L	231	227	235	128	18	224	9.6	2.0	36				
Bicarbonate (as HCO3)	mg/L	281	276	286	163	25	265	9.2	0	44				
Carbonate (as CO3)	mg/L	<1	<1	<1	<1	<1	<1	2.5	0	24				
Color	C.U.	10	5	15	16	5	25	na	na	na				
Conductivity (field)	umhos/cm	1823	1680	1940	283	61	453	40	7.0	399				
Conductivity (lab)	umhos/cm	na	na	na	302	79	500	na	na	na				
Nitrate + Nitrite (as N)	mg/L	<0.1	<0.1	<0.1	0.24	0.10	1.0	na	na	na	11	0	0	na
Odor	T.O.N.	na	na	na	1.6	1.0	3.0	na	na	na				
pH (lab)	s.u.	8.0	8.0	8.1	7.5	5.7	9.0	na	na	na	6.5-8.5 (s)	0	3	na
pH (field)	s.u.	7.8	7.7	8.0	7.1	5.4	8.8	5.6	4.7	6.7	6.5-8.5 (s)	0	12	49
Phenol	mg/L	na	na	na	0.08	0.04	0.11	na	na	na				
Sulfate (field)	mg/L	<1	<1	<1	9.6	1.0	44	10	0.25	190	250	0	0	0
Temperature (field)	°C	na	na	na	18	15	21	17	15	20				
Total dissolved solids	mg/L	930	840	980	177	30	390	29	8.0	300	500 (s)	4	0	0
Total Hardness (as CaCO3)	mg/L	48	36	53	93	8.0	200	na	na	na				
Turbidity	NTU	8	2.1	19	na	na	na	na	na	na				
Gross Alpha	pCi/L	1.6	0	3.1	na	na	na	na	na	na	15	0	na	na
Gross Beta	pCi/L	0.3	0	1.1	na	na	na	na	na	na	50	0	na	na
Radium-226	pCi/L	0.4	0	1.3	na	na	na	na	na	na				
Radium-228	pCi/L	1.6	1.0	2.0	na	na	na	na	na	na				
Radium (total)	pCi/L	2.0	1.0	3.3	na	na	na	na	na	na	5	0	na	na
Boron	mg/L	0.48	0.47	0.49	0.07	0.05	0.11	na	na	na				
Calcium	mg/L	16	12	18	24	3.0	54	2.6	0.20	36				
Chloride	mg/L	417	342	460	4.9	1.0	10	5.3	1.2	40	250 (s)	4	0	0
Fluoride	mg/L	1.2	1.2	1.3	0.11	0.10	0.20	na	na	na	4	0	0	na
Magnesium	mg/L	2.0	2.0	2.0	8.3	1.0	17	2.3	0.25	41				
Phosphorous, total	mg/L	<0.1	<0.1	<0.1	2.5	0.10	23	na	na	na				
Potassium	mg/L	4.0	4.0	4.0	2.9	1.0	6.0	0.81	0.25	2.5				
Silica (as Si)	mg/L	14	8.0	17	15	6.3	30	na	na	na				
Sodium	mg/L	343	317	377	28	6.0	76	4.4	1.0	26				
Iron, dissolved	mg/L	0.89	0.63	1.24	1.85	0.05	8.6	na	na	na	0.3 (s)	4	23	na
Iron, total	mg/L	1.65	0.76	2.16	4.10	0.09	57	1.5	0.01	16	0.3 (s)	4	27	31
Manganese, dissolved	mg/L	0.04	0.01	0.06	0.20	<0.01	0.35	na	na	na	0.05 (s)	1	41	na
Manganese, total	mg/L	0.05	0.01	0.07	0.24	0.06	1.08	0.1	0.0	1.4	0.05 (s)	2	34	12
Aluminum, dissolved	mg/L	<0.1	<0.1	<0.1	0.2	<0.1	0.4	na	na	na	0.05 (s)	**	>3	na
Arsenic, dissolved	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.009	na	na	na	0.05	0	1	na
Barium, dissolved	mg/L	0.09	0.08	0.11	0.12	0.01	0.28	na	na	na	2	0	0	na
Beryllium, dissolved	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	na	na	na	0.004	**	1	na
Cadmium, dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	na	na	na	0.005	0	0	na
Chromium, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	na	na	na	0.1	0	0	na
Cobalt, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	na	na	na				
Copper, dissolved	mg/L	<0.01	<0.01	<0.01	0.02	<0.01	0.05	na	na	na	1.30	0	0	na
Lead, dissolved	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	na	na	na	0.05	0	0	na
Mercury, dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	na	na	na	0.002	0	0	na
Molybdenum, dissolved	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	na	na	na				
Nickel, dissolved	mg/L	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	na	na	na	0.1	0	0	na
Selenium, dissolved	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	na	na	na	0.05	0	0	na
Silver, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	na	na	na	0.1	0	0	na
Strontium, dissolved	mg/L	0.64	0.50	0.72	0.595	0.07	1.76	na	na	na				
Thallium, dissolved	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	na	na	na	0.002	**	**	na
Zinc, dissolved	mg/L	<0.02	<0.02	<0.02	0.05	<0.02	0.14	na	na	na	5	0	0	na

NOTES: na = not applicable or not measured; * = primary standard unless followed by "(s)" indicating secondary standard; ** = cannot be determined because analytical detection limit is greater than MCL Sources: R.W. Harden & Associates (1997); MLMC (1997)

old. Much more info available in 2/23/98 [illegible] permit app. update

Appendix C-14 Surface Water Resources - Quality Data

Table C-14.1 Summary of Surface Water Quality

Parameter	Streams[1]				Surface Impoundments[2]			
	# Samples	Average[3]	Max	Min	# Samples	Average	Max	Min
Flow (cfs)	34	17.04	189.59	1.03				
pH (lab) (s.u.)	28		7.40	6.50				
pH (field) (s.u.)	28		7.14	6.12	54		8.80	5.51
Acidity (mg/L)	28	<1	1.00	<1	54	6.96	22.00	1.00
Alk. (as CaCo3) (mg/L)	28	13.93	26.00	8.00	54	12.48	24.00	4.90
B (mg/L)	11	<0.05	<0.05	<0.05				
BOD (mg/L)	11	<2	<2	<2				
COD (mg/L)	11	11.82	23.00	<5				
Chlorine (total res.) (mg/L)	11	<2	<0.50	<0.1	54	2.89	10.00	0.73
Coliform (total) (Col/100 mL)	11	*200	>1098.00	<2				
Color (C.U.)	11	6.36	15.00	<5				
Conductivity (lab) (umhos/cm)	28	60.41	95.00	28.00				
Conductivity (field) (umhos/cm)	28	56.00	84.00	28.00	54	48.44	230.00	15.00
Cyanide (mg/L)	11	<0.01	<0.01	<0.01				
Dissolved Oxygen (mg/L)	28	9.26	11.80	7.20	38	8.09	11.79	1.05
Fecal Coliform (Col/100 mL)	11	*71.00	732.00	<2				
F (mg/L)	11	<0.18	0.60	<0.10				
Hardness (as CaCO3 (mg/L)	11	<13.09	20.00	<1				
Nitrogen, Organic (mg/L)	11	0.45	1.40	0.30				
Nitrogen, Ammonia (mg/L)	11	0.12	0.20	<0.1				
Nitrogen, Nitrate (mg/L)	11	0.11	0.14	<0.1				
Nitrogen, Nitrite (mg/L)	11	<0.1	<0.1	<0.1				
Odor (TON)	11	<1	<1	<1				
Oil and Grease (mg/L)	11	<5	<5	<5				
Phenol (mg/L)	11	<0.015	0.03	<0.01				
P (ortho) (mg/L)	11	<0.1	<0.1	<0.1				
P (total) (mg/L)	11	<0.1	<0.1	<0.1				
Si (as Si) (mg/L)	11	9.45	10.80	7.67				
Settleable Solids (mL/L)	11	<5	<5	<5				
TDS (mg/L)	28	48.41	80.00	20.00	54	36.37	170.00	9.00
TSS (mg/L)	28	16.56	52.00	4.00				
TOC (mg/L)	28	4.33	7.00	3.00				
Turbidity (NTU)	11	23.82	40.00	10.00				
Ca (mg/L)	11	3.00	4.00	2.00	54	2.68	14.00	0.77
Mg (mg/L)	11	1.64	3.00	1.00	54	1.85	18.00	0.43
K (mg/L)	11	<1.18	2.00	<1	54	1.82	6.90	0.32
Na (mg/L)	11	3.82	5.00	3.00	54	2.64	21.00	0.37
HCO3 (as HCO3) (mg/L)	11	13.82	18.00	11.00	54	9.15	29.00	0.00

Table C-14.1 Summary of Surface Water Quality

Parameter	Streams[1] # Samples	Streams Average[3]	Streams Max	Streams Min	Surface Impoundments[2] # Samples	Surface Impoundments Average	Surface Impoundments Max	Surface Impoundments Min
CO3 (as CO3) (mg/L)	11	<1	<1	<1	54	5.52	27.00	0.00
Cl (mg/L)	11	3.73	5.00	2.00	54	2.89	10.00	0.73
SO4 (mg/L)	11	7.27	12.00	3.00	54	6.17	130.00	0.51
Temp (field) (°C)	28	13.26	20.94	5.80	54	22.66	28.84	14.65
Diss. Al (mg/L)	11	<0.12	0.20	<0.10				
Diss. As (mg/L)	11	<0.005	<0.005	<0.005				
Diss. Ba (mg/L)	11	0.08	0.10	0.04				
Diss. Be (mg/L)	11	<0.005	<0.005	<0.005				
Diss. Cd (mg/L)	11	<0.001	<0.001	<0.001				
Diss. Cr (hexavalent) (mg/L)	11	<0.02	<0.02	<0.02				
Diss. Cr (trivalent) (mg/L)	11	<0.02	<0.02	<0.02				
Diss. Total Cr (mg/L)	11	<0.02	<0.02	<0.02				
Diss. Co (mg/L)	11	<0.02	<0.02	<0.02				
Diss. Cu (mg/L)	11	<0.01	<0.01	<0.01				
Diss. Fe (mg/L)	28	0.25	0.73	0.14				
Diss. Pb (mg/L)	11	<0.006	0.01	<0.005				
Diss. Mn (mg/L)	28	0.09	0.25	0.03				
Diss. Hg (mg/L)	11	<0.001	<0.001	<0.001				
Diss. Mo (mg/L)	11	<0.05	<0.05	<0.05				
Diss. Ni (mg/L)	11	<0.05	<0.05	<0.05				
Diss. Se (mg/L)	11	<0.005	<0.005	<0.005				
Diss. Ag (mg/L)	11	<0.01	<0.01	<0.01				
Diss. Sr (mg/L)	11	<0.03	0.05	<0.01				
Diss. Tl (mg/L)	11	<0.005	<0.005	<0.005				
Diss. Zn (mg/L)	11	0.02	0.03	0.02				
Total Fe (mg/L)	28	1.65	2.72	1.02	54	1.78	6.90	0.04
Total Mn (mg/L)	28	0.11	0.26	0.03	54	0.13	0.89	0.01
Pesticides (mg/L)	2	N D	N D	N D				
PCB (mg/L)	2	N D	N D	N D				
VOCs (mg/L)	2	N D	N D	N D				
SVOCs (mg/L)	2	N D	N D	N D				
Dioxin (mg/L)	2	N D	N D	N D				

Notes :

1. Combinations of data for 7 stream locations. Data for each location is contained in the mine permit application (MLMC 1997).
2. Combinations of data from 54 ponds or impoundments. Data for each location is contained in the mine permit application (MLMC 1997).
3. Values below detection limits are listed with a less than symbol (<). This includes averages with < values.

* In coliform averages indicates that these are median numbers.

N D Indicates none detected.

Appendix C-15 Aquatic Ecology - Stream Survey Results

Table C-15.1 List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, April 1997

Taxon	Big Bywy Ditch @ Hwy. 9	Big Bywy Ditch @ Hwy. 15	Big Bywy Ditch @ Chester-Tomnolen Rd.	Swamp off Big Bywy Ditch @ Hebron Rd.	Middle Bywy Creek @ Natchez Trace Pkwy.	Middle Bywy Creek @ Bywy Rd.	Middle Bywy Creek @ Hwy. 9	Middle Bywy Creek @ Prewitt Rd.	Jenkins Creek @ Chapel Hill Rd.
Nematamorpha	.	.	.	.	.	.	.	.	X
Oligochaeta									
Haplotaxida									
Naididae	.	.	.	X	.	.	.	.	.
Tubificidae	.	.	.	X	.	.	.	.	.
Branchiobdellida	.	.	.	X	X	.	.	.	.
Crustacea									
Isopoda									
Asellidae									
Caecidotea sp.	.	.	X	X	.	.	.	.	.
Lirceus sp.	.	.	.	X	.	.	.	.	.
Amphipoda									
Crangonyctidae									
Crangonyx sp.	.	X	X	X	X	.	.	.	X
Talitridae									
Hyalella azteca	.	.	X	X	.	.	.	X	.
Decapoda									
Cambaridae	X	.	X	.	X	X	.	X	.
Orconectes sp.	.	.	.	.	.	.	X	.	.
Procambarus sp.	.	X	.	X	.	X	X	X	X
Palaemonidae									
Palaemonetes kadiakensis	X	.	X	.	.	.	.	.	.
Insecta									
Plecoptera									
Nemouridae									
Amphinemura sp.	X	.	.	.	X	X	X	X	.
Perlidae									
Eccoptura xanthenes	.	.	.	.	.	.	.	.	X
Neoperla sp.	.	.	.	.	X	.	.	.	
Perlesta placida	X	X	X	.	X	X	X	X	X
Odonata									
Aeshnidae									
Boyeria vinosa	.	X	X	.	X	X	X	X	X
Nasiaeschna pentacantha	.	.	.	X	.	.	.	.	.
Calopterygidae									
Calopteryx sp.	.	.	X	.	X	.	.	.	.
Calopteryx maculata	X	X	.		X	X		X	X
Coenagrionidae	.	X	X	X	.	.	.	.	X
Argia sp.	X	.	.	.	.	.	.	.	X
Cordulegastridae									
Cordulegaster sp.	.	.	.	.	X	.	X	.	.
Corduliidae									
Macromia sp.	X	.	X	.	.	X	.	.	X
Gomphidae									
Gomphus sp.	.	.	.	.	X	.	X	.	X
Progomphus obscurus	X	X	X	.	X	X	X	.	X
Lestidae									
Lestes inaequalis	.	.	.	X	.	.	.	.	.
Libellulidae									
Erythemis sp.	.	.	.	X	.	.	.	.	.
Libellula vibrans	.	.	.	X	.	.	.	.	.
Ephemeroptera									
Baetidae									
Acentrella ampla	.	.	.	.	.	.	X	X	X
Acentrella sp.	.	.	.	.	.	.	.	X	.
Baetis sp.	.	.	.	.	X	.	.	.	.

Table C-15.1 List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, April 1997

Taxon	Big Bywy Ditch @ Hwy. 9	Big Bywy Ditch @ Hwy. 15	Big Bywy Ditch @ Chester-Tomnolen Rd.	Swamp off Big Bywy Ditch @ Hebron Rd.	Middle Bywy Creek @ Natchez Trace Pkwy.	Middle Bywy Creek @ Bywy Rd.	Middle Bywy Creek @ Hwy. 9	Middle Bywy Creek @ Prewitt Rd.	Jenkins Creek @ Chapel Hill Rd.
Baetis intercalaris	.	.	.	.	X	.	.	.	.
Baetiscidae									
Baetisca obesa	.	.	.	.	.	.	.	X	X
Caenidae									
Caenis sp.	X	.	X	X	X	X	.	X	X
Ephemerelidae									
Eurylophella sp.	.	.	.	.	.	.	.	.	X
Ephemeridae									
Hexagenia sp.	.	.	.	X	X	.	.	.	X
Heptageniidae	.	X	.	.	.	.	.	.	.
Stenacron interpunctatum	.	X	.	.	X	.	.	X	X
Stenonema modestum	X	X	X	.	X	X	X	X	X
Isonychiidae									
Isonychia sp.	X	.	.	.	.	.	.	.	.
Leptophlebiidae									
Leptophlebia sp.	.	.	.	.	.	.	.	.	X
Paraleptophlebia sp.	.	.	.	.	X	X	.	.	.
Hemiptera									
Belostomatidae									
Belostoma sp.	.	.	.	.	.	.	.	.	X
Corixidae	.	.	.	X	.	.	.	.	.
Gerridae									
Gerris sp.	.	X	.	X	X	.	X	.	.
Nepidae									
Ranatra sp.	.	.	.	X	.	.	.	.	.
Trichoptera									
Hydropsychidae									
Cheumatopsyche sp.	X	X	.	.	X	X	X	X	.
Hydropsyche betteni	.	.	.	.	.	.	X	.	X
Leptoceridae									
Nectopsyche sp.	X	.	.	.	.	.	.	.	.
Limnephilidae									
Hydatophylax sp.	.	X	.	.	.	.	.	.	.
Pycnopsyche sp.	.	.	.	.	.	.	.	X	X
Rhyacophilidae									
Rhyacophila sp.	.	X	.	.	.	.	.	.	.
Megaloptera									
Corydalidae									
Chauliodes sp.	.	.	X	.	.	.	.	.	.
Corydalus cornutus	.	X	.	.	.	X	X	.	.
Diptera									
Ceratopogonidae									
Bezzia sp.	.	.	X	X	.	X	.	.	.
Culicoides sp.	.	.	.	X	.	.	.	.	.
Chironomidae	.	X	.						
Chironomus sp.	.	X	.	X	.	.	.	.	.
Cladopelma sp.				X	.	.	.	.	.
Cladotanytarsus sp.	.	.	X	.	.	.	.	.	.
Cricotopus sp.	.	.	.	.	.	X	.	.	X
Cricotopus bicinctus	X	X	.	.	.	.	.	.	.
Endochironomus sp.	.	.	.	X	.	.	.	.	.
Glyptotendipes sp.	.	.	.	X	.	.	.	.	.
Parakiefferiella sp.	.	.	X	.	.	.	.	.	.
Parametriocnemus lundbec	.	.	.	.	.	X	.	X	X
Paratendipes sp.	.	.	.	.	.	.	.	.	X
Pentaneura sp.	X	.	.	.	X	.	.	.	.
Polypedilum convictum	.	.	.	.	.	X	.	X	.
Polypedilum fallax	.	.	X	.	X		X	.	.
Polypedilum halterale	.	.	.	.	.	X	X	.	.

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Taxon	Big Bywy Ditch @ Hwy. 9	Big Bywy Ditch @ Hwy. 15	Big Bywy Ditch @ Chester-Tomnolen Rd.	Swamp off Big Bywy Ditch @ Hebron Rd.	Middle Bywy Creek @ Natchez Trace Pkwy.	Middle Bywy Creek @ Bywy Rd.	Middle Bywy Creek @ Hwy. 9	Middle Bywy Creek @ Prewitt Rd.	Jenkins Creek @ Chapel Hill Rd.
Polypedilum illinoense	X	X	.	X	.	.	X	.	.
Procladius sp.	.	.	.	X	.	.	.	.	.
Pseudochironomus sp.	.	.	.	.	.	.	.	X	.
Rheocricotopus robacki	.	X	.	.	X	X	.	.	.
Stictochironomus sp.	.	X	.	.	.	X	.	.	X
Tanytarsus sp.					X	.	.	.	.
Thienemannimyia sp.	X	.	X		X	.	.	X	X
Culicidae									
Anopheles sp.	.	.	.	X	.	.	.	.	.
Simuliidae	.	X	.	.	.	.	.	.	.
Simulium sp.	.	X	X	.	.	X	X	X	
Tabanidae	.	X	.	.	X	.	.	.	.
Tipulidae									
Hexatoma sp.	.	.	.	.	.	.	.	X	.
Tipula sp.	X	.	.		X	.	X	X	.
Coleoptera									
Dryopidae									
Helichus basalis	.	.	X	.	X	.	.	X	X
Helichus lithophilus	.	.	.	.	.	X	.	.	.
Dytiscidae	.	X	.	.	.	.	.	.	.
Cybister sp.	.	.	.	X	.	.	.	.	.
Hydroporus sp.	.	.	.	X	.	.	.	.	.
Laccophilus sp.	.	.	.	X	.	.	.	.	.
Elmidae									
Ancyronyx variegatus	X	.	.	.	.	.	.	.	.
Stenelmis sp.	X	.	.	.	.	.	.	X	.
Gyrinidae									
Dineutus sp.	X	X	.	X	X	X	X	.	.
Gyretes sp.	X	.	X	.	.	.	.	.	.
Gyrinus sp.	X	.	.	.	.	.	.	.	X
Haliplidae									
Peltodytes sp.	X	.	.	X	.	.	.	.	.
Basommatophora									
Physidae									
Physella sp.	.	.	.	X	.	.	.	.	.
Veneroida									
Corbiculidae									
Corbicula fluminea	X	.	X	.	.	.	.	.	.
Sphaeriidae									
Sphaerium simile	.	X	.	.	.	.	.	.	.
	25	27	23	33	30	23	20	23	29
	8	7	3	2	11	6	6	6	11
Oligochaeta									
Haplotaxida									
Tubificidae	.	.	.	.	.	X	X	X	.
Limnodrilus hoffmeisteri	.	.	.	.	.	.	X	X	.
Branchiobdellida	.	.	.	X	X	.	.	X	.
Crustacea									
Isopoda									
Asellidae									
Caecidotea sp.	.	.	.	.	X	X	.	.	X
Amphipoda									
Crangonyctidae									
Crangonyx sp.	X	.	X	X	.	.	X	X	.
Talitridae									
Hyalella azteca	.	.	X	.	X	.	.	.	X
Decapoda									

Table C-15.1 List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, April 1997

Taxon	Big Bywy Ditch @ Hwy. 9	Big Bywy Ditch @ Hwy. 15	Big Bywy Ditch @ Chester-Tomnolen Rd.	Swamp off Big Bywy Ditch @ Hebron Rd.	Middle Bywy Creek @ Natchez Trace Pkwy.	Middle Bywy Creek @ Bywy Rd.	Middle Bywy Creek @ Hwy. 9	Middle Bywy Creek @ Prewitt Rd.	Jenkins Creek @ Chapel Hill Rd.
Cambaridae	X	.	.	X	X	X	.	X	.
Cambarus sp.	.	.	.	.	.	.	.	.	X
Orconectes sp.	.	.	.	.	X	.	X		
Procambarus sp.	X	X	X	X	X	X	X	X	X
Palaemonidae									
Palaemonetes kadiakensis	.	.	.	.	.	.	.	X	X
Insecta									
Plecoptera									
Leuctridae									
Leuctra sp.	.	.	.	X	.	X		.	X
Nemouridae									
Amphinemura sp.	X	.	X	X	.	X	.	.	.
Perlidae								X	.
Acroneuria mela	.	.	.	.	.	.	.	X	X
Eccoptura xanthenes	X	.	.	.	.	.	.	.	.
Neoperla sp.	.	.	.	.	X	.	.	.	X
Perlesta placida	X	X	.	X	X	.	X	X	X
Perlodidae									
Isoperla sp.	X	X	.	.	.	.	.	.	X
Odonata									
Aeshnidae									
Boyeria vinosa	X	X	.	X	X	X	.	.	X
Calopterygidae									
Calopteryx maculata	X	X	.	X	X	X	.	X	X
Coenagrionidae	.	.	X	.	.	.	.	.	.
Argia sp.	.	X	.	.	X	.	.	X	X
Cordulegastridae									
Cordulegaster sp.	X	X	.	.	.	X	.	.	X
Corduliidae									
Didymops transversa	.	.	.	.	.	X	.	X	.
Macromia sp.	.	X	.	.	.	.	.	X	X
Somatochlora sp.						X			
Gomphidae									
Dromogomphus spinosus	.	.	.	.	.	.	.	X	X
Gomphus sp.	.	X	.	.	.	.	X	X	X
Hagenius brevistylus	.	.	.	.	.	.	.	X	.
Progomphus obscurus	X	X	X	X	X	.	.	X	X
Libellulidae									
Perithemis sp.	.	.	X	.	.	.	.	.	.
Ephemeroptera									
Baetidae	X	X	.	X	X	.	.	X	X
Acentrella ampla	X	X	X	.	X	.	.	X	.
Baetis sp.	.	.	.	.	X	.	.	X	.
Baetis intercalaris	X	.	.	X	.	.	.	X	.

Table C.15-2a List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, July 1997

Taxon	Little Bywy Creek @ Salem-Bankston Rd.	Little Bywy Creek @ Natchez Trace Pkwy.	Log Branch @ Prewitt Rd.	Bowie Branch @ Hwy. 415	Stewart Creek @ Sturgis-Reform Rd.	Besa Chitto Creek @ Hwy. 9	Besa Chitto Creek @ Stewart Rd.	McCurtain Creek @ Talley Rd.	McCurtain Creek @ Watson-Bankston Rd.
Nematoda	X	.	.	.	.	.	.	.	.
Turbellaria									
Tricladia									
Planariidae									
Dugesia tigrina	.	.	.	.	.	.	.	.	X
Oligochaeta									
Haplotaxida									
Tubificidae	.	X	.	.	.	.	X	.	.
Limnodrilus hoffmeisteri	.	.	.	.	.	.	X	.	.
Lumbriculida									
Lumbriculidae	.	.	.	.	.	X	.	X	.
Hirudinea									
Pharyngobdellida									
Erpobdella punctata	.	.	.	.	.	.	X	.	.
Branchiobdellida	.	X	.	.	.	.	.	.	.
Crustacea									
Isopoda									
Asellidae									
Caecidotea sp.	.	.	.	.	X	.	X	X	X
Amphipoda									
Crangonyctidae									
Crangonyx sp.	X	.	X	X	.	.	X	.	.
Talitridae									
Hyalella azteca	.	.	.	.	X	.	.	X	X
Decapoda									
Cambaridae	X	X	X	X	.	X	X	X	X
Cambarus sp.						X		.	.
Orconectes sp.	X	X	.	.	.	.	.	X	X
Procambarus sp.	.	.	.	X	.	X	X	.	.
Palaemonidae									
Palaemonetes kadiakensis	.	.	.	.	.	.	X	X	X
Insecta									
Plecoptera									
Perlidae									
Acroneuria sp.	.	.	.	.	.	.	.	.	X
Acroneuria abnormis	X	.	.	.	.	.	.	X	.
Acroneuria mela	.	.	.	.	.	.	.	.	X
Neoperla sp.	.	X	.	.	.	.	.	X	X
Odonata									
Aeshnidae									
Boyeria vinosa	X	X	.	.	X	X	.	X	X
Calopterygidae									

Table C.15-2a List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, July 1997

Taxon	Little Bywy Creek @ Salem-Bankston Rd.	Little Bywy Creek @ Natchez Trace Pkwy.	Log Branch @ Prewitt Rd.	Bowie Branch @ Hwy. 415	Stewart Creek @ Sturgis-Reform Rd.	Besa Chitto Creek @ Hwy. 9	Besa Chitto Creek @ Stewart Rd.	McCurtain Creek @ Talley Rd.	McCurtain Creek @ Watson-Bankston Rd.
Calopteryx sp.	X	X	X	X	X	X	.	.	X
Calopteryx maculata	.	.	.	.	.	.	.	.	.
Hetaerina sp.	.	.	.	X	.	.	.	.	.
Coenagrionidae	.	.	X	.	X	.	.	X	.
Argia sp.	.	X	.	.	X	.	.	.	.
Enallagma sp.	.	.	.	.	.	.	X	.	X
Cordulegastridae									
Cordulegaster sp.	.	.	.	.	.	X	.	.	.
Corduliidae	.	.	.	.	.	.	.	X	X
Macromia sp.	.	.	.	X	.	.	.	X	X
Neurocordulia sp.	.	.	X	.	.	.	.	.	.
Gomphidae	X	.	.	.	.	.	.	.	.
Dromogomphus sp.	.	.	.	.	.	.	.	.	X
Gomphus sp.	X	.	.	X	.	.	.	X	X
Progomphus obscurus	.	X	.	X	.	.	.	X	X
Libellulidae	.	.	.	.	.	.	.	.	X
Ephemeroptera									
Baetidae	.	X	.	.	X	.	.	.	.
Acentrella ampla	X	X	.	.	X	.	.	X	.
Baetis sp.	X	.	.	.	.	.	.	.	.
Baetis intercalaris	X	.	.	X	X	.	.	.	X
Centroptilum sp.	X	.	.	X	X	.	.	X	X
Caenidae									
Brachycercus sp.	.	.	.	.	X	.	.	.	.
Caenis sp.	X	.	X	X	X	X	.	X	X
Ephemeridae									
Hexagenia sp.	X	X	.	X	X	.	.	.	X
Heptageniidae									
Stenacron interpunctatum	X	X	X	X	X	X	.	X	X
Stenonema sp.	.	.	.	.	.	X	.	.	X
Stenonema modestum	X	X	X	X	X	.	.	X	X
Isonychiidae									
Isonychia sp.	X	X	X	X	X	.	.	X	X
Tricorythidae									
Tricorythodes sp.	.	.	.	.	.	.	.	X	.
Hemiptera									
Belastomatidae									
Belastoma sp.	.	.	.	.	.	.	.	X	.
Corixidae	.	.	.	.	X	.	X	.	X
Trichocorixa sp.	.	.	.	.	X	.	.	X	.
Gerridae	.	.	X	.	.	.	.	.	.
Gerris sp.	X	.	.	.	X	.	X	.	.
Metrobates sp.	.	.	.	.	.	.	.	X	X
Rhuematobates sp.	.	.	.	.	.	.	.	X	.

Table C.15-2a List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, July 1997

Taxon	Little Bywy Creek @ Salem-Bankston Rd.	Little Bywy Creek @ Natchez Trace Pkwy.	Log Branch @ Prewitt Rd.	Bowie Branch @ Hwy. 415	Stewart Creek @ Sturgis-Reform Rd.	Besa Chitto Creek @ Hwy. 9	Besa Chitto Creek @ Stewart Rd.	McCurtain Creek @ Talley Rd.	McCurtain Creek @ Watson-Bankston Rd.
Hydrometridae									
Hydrometra sp.	.	.	.	X	.	.	.	X	.
Veliidae	.	.	.	X	.	.	.	.	.
Trichoptera									
Hydropsychidae									
Cheumatopsyche sp.	X	X	X	X	X	X	X	X	.
Hydropsyche sp.	.	X	.	.	.	X	.	.	.
Limnephilidae									
Pycnopsyche sp.	.	.	.	X	.	.	.	.	.
Philopotamidae									
Chimarra sp.	.	.	.	.	.	.	.	X	.
Polycentropodidae									
Polycentropus sp.	.	.	.	X	.	.	.	X	.
Megaloptera									
Corydalidae									
Corydalus cornutus	X	.	X	X	.	.	.	X	X
Nigronia serricornis	X	X	.	.	.	.	.	.	.
Sialidae									
Sialis sp.	X	.	.	.	X	X	.	X	X
Diptera									
Chironomidae	X	X	.	X	X	.	X	.	.
Ablabesmyia mallochi	.	.	X	.	.	.	.	X	X
Brilla flavifrons	.	.	.	.	.	.	.	X	.
Chironomus sp.	X	X	X	.	X	.	.	.	.
Clinotanypus pinguis	.	.	.	.	.	.	.	.	X
Conchapelopia sp.	X	.	.	.	.	.	.	.	.
Cryptochironomus fulvus	X	.	.	.	.	.	X	.	X
Dicrotendipes sp.	.	.	.	.	.	.	.	.	X
Glyptotendipes sp.	.	.	.	.	.	.	X.	.	.
Microtendipes sp.	X	.	X	X	.	.	.	.	.
Paratendipes sp.	X	.	.	X	.	.	.	.	.
Phaenopsectra sp.	.	.	X	.	.	.	.	.	.
Polypedilum sp.	.	.	.	.	X	X	X	X	.
Polypedilum convictum	X	X	.	X	X	.	.	X	.
Polypedilum fallax	X	.	.	.	.	.	.	.	.
Polypedilum halterale	.	.	.	X	.	.	.	X	.
Polypedilum illinoense	X	X	.	.	.	.	.	X	X
Procladius sp.	X	.	.	.	.	.	.	.	X
Rheocricotopus robacki	.	.	.	X	.	.	.	.	.
Rheosmittia sp.	X	.	.	.	.	.	.	.	.
Rheotanytarsus sp.	X	X	.	X	.	X	X	.	.
Stenochironomus sp.	.	.	.	.	.	.	.	.	X
Stictochironomus sp.	.	.	X	.	.	X	X	.	.
Tanytarsus sp.	X	X	.	X	.	.	.	.	X

Table C.15-2a List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, July 1997

Taxon	Little Bywy Creek @ Salem-Bankston Rd.	Little Bywy Creek @ Natchez Trace Pkwy.	Log Branch @ Prewitt Rd.	Bowie Branch @ Hwy. 415	Stewart Creek @ Sturgis-Reform Rd.	Besa Chitto Creek @ Hwy. 9	Besa Chitto Creek @ Stewart Rd.	McCurtain Creek @ Talley Rd.	McCurtain Creek @ Watson-Bankston Rd.
Thienemannimyia sp.	.	X	.	X	X	X	.	.	.
Tribelos sp.	.	X	.	X	.	.	.	X	X
Tribelos jucundus	X	.	.	.	.	.	.	.	.
Zavrelia sp.	.	.	.	.	X	.	.	.	.
Dixidae									
Dixella sp.	X	.	.	.	.	.	.	.	.
Empididae	.	.	.	.	.	X	.	.	.
Hemerodromia sp.	.	.	.	.	.	X	.	.	.
Simuliidae									
Simulium sp.	X	X	.	X	X	.	.	X	X
Tabanidae	.	.	.	X	.	.	.	.	.
Tipulidae									
Hexatoma sp.	.	.	.	X	.	.	.	.	.
Limnophila sp.	.	.	.	.	.	.	.	.	X
Tipula sp.	X	.	.	.	.	.	.	.	.
Coleoptera									
Dryopidae									
Helichus sp.	.	.	.	.	.	X	.	.	.
Helichus basalis	X	.	.	X	.	.	.	.	.
Helichus lithophilus	.	X	.	.	.	.	.	.	X
Dytiscidae	X	.	.	.	X	X	X	.	X
Hydroporus sp.	X	.	X	X	X	X	X	X	.
Elmidae									
Ancyronyx variegatus	X	X	.	X	X	.	.	X	X
Dubiraphia sp.		X	.	.	.	X	.	X	.
Dubiraphia vittata	X	.	.	.	.	.	.	.	.
Macronychus glabratus	X	X	.	X	X	.	.	X	X
Stenelmis sp.	X	X	.	.	.	X	.	X	X
Stenelmis crenata	.	.	.	.	.	.	.	X	.
Gyrinidae									
Dineutus sp.	X	X	X	.	X	X	X	X	X
Gyretes sp.	.	X	.	.	.	.	.	.	X
Gyrinus sp.	.	.	.	X	X	X	.	.	X
Haliplidae									
Peltodytes sp.	.	.	.	.	X	.	.	X	.
Peltodytes sexmaculatus	.	.	.	.	.	.	.	.	X
Hydrophilidae									
Scirtidae	.	.	.	.	X	.	.	.	.
Staphylinidae	.	.	.	.	.	.	X	.	.
Arachnoidea									
Acariformes	.	.	.	.	.	.	.	X	.
Gastropoda									
Basommatophora									
Physidae									

Table C.15-2a List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, July 1997

Taxon	Little Bywy Creek @ Salem-Bankston Rd.	Little Bywy Creek @ Natchez Trace Pkwy.	Log Branch @ Prewitt Rd.	Bowie Branch @ Hwy. 415	Stewart Creek @ Sturgis-Reform Rd.	Besa Chitto Creek @ Hwy. 9	Besa Chitto Creek @ Stewart Rd.	McCurtain Creek @ Talley Rd.	McCurtain Creek @ Watson-Bankston Rd.
Physella sp.	.	.	X	.	X	.	X	.	.
Bivalvia									
Veneroida									
Corbiculidae									
Corbicula fluminea	.	.	.	.	.	.	.	X	.
Number of taxa	48	34	20	39	37	27	23	49	50
Number of EPT taxa	11	9	5	10	11	5	1	12	11

Table C-15.2b List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, July 1997

Taxon	Big Bywy Ditch @ Hwy. 9	Big Bywy Ditch @ Hwy. 15	Middle Bywy Creek @ Natchez Trace Pkwy.	Middle Bywy Creek @ Bywy Rd.	Middle Bywy Creek @ Hwy. 9	Middle Bywy Creek @ Prewitt Rd.	Jenkins Creek @ Chapel Hill Rd.
Oligochaeta							
Lumbriculida							
Lumbriculidae							
Lumbriculus sp.	.	.	.	.	.	.	X
Branchiobdellida	.	.	X	.	.	.	X
Crustacea							
Isopoda							
Asellidae							
Caecidotea sp.	.	X	.	.	.	.	.
Amphipoda							
Crangonyctidae							
Crangonyx sp.	.	.	X	.	X	.	X
Talitridae							
Hyalella azteca	.	X	.	.	.	.	.
Decapoda							
Cambaridae	X	.	X	.	X	.	X
Orconectes sp.	.	.	X	.	X	.	.
Procambarus sp.	X	.	X	.	X	X	X
Insecta							
Collembola							
Isotomidae	.	.	.	X	.	.	.
Plecoptera							
Perlidae	.	.	X	.	X	.	.
Neoperla sp.	.	.	.	X	.	X	.
Odonata							
Aeshnidae							
Boyeria vinosa	X	X	X	.	X	X	.
Calopterygidae							
Calopteryx sp.	.	X	.	.	X	X	X
Coenagrionidae	.	X	.	X	.	.	.
Argia sp.	X	.	.	.	.	.	.
Argia sedula	.	.	.	.	.	.	X
Enallagma sp.	X	.	.	.	.	.	.
Cordulegastridae							
Cordulegaster sp.	.	.	.	.	X	.	.
Corduliidae							
Neurocordulia sp.	.	X	.	.	.	.	.
Gomphidae	.	X	.	.	.	X	.
Gomphus sp.	.	.	.	X	.	.	X
Progomphus obscurus	X	X	X	X	X	X	X
Ephemeroptera							
Baetidae	X	X	.	.	.	.	.
Acentrella ampla	X	X	.	X	X	X	.
Baetis sp.	X	X	.	.	.	.	.

Table C-15.2b List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, July 1997

Taxon	Big Bywy Ditch @ Hwy. 9	Big Bywy Ditch @ Hwy. 15	Middle Bywy Creek @ Natchez Trace Pkwy.	Middle Bywy Creek @ Bywy Rd.	Middle Bywy Creek @ Hwy. 9	Middle Bywy Creek @ Prewitt Rd.	Jenkins Creek @ Chapel Hill Rd.
Baetis intercalaris	X	X	X	X	X	X	.
Centroptilum sp.	.	X	X	X	X	.	X
Caenidae							
Caenis sp.	X	X	X	X	X	.	.
Ephemeridae							
Hexagenia sp.	.	.	.	X	X	.	X
Heptageniidae							
Stenacron interpunctatum	X	X	X	X	.	.	.
Stenonema sp.	X	X	.	.	X	.	.
Stenonema modestum	X	X	X	X	X	X	X
Isonychiidae							
Isonychia sp.	X	X	X	X	X	X	.
Tricorythidae							
Tricorythodes sp.	X	.	X	X	.	.	.
Hemiptera							
Corixidae	.	.	.	X	X	.	X
Gerridae	.	.	.	.	.	.	X
Gerris sp.	.	.	X	.	X	X	.
Trichoptera							
Hydropsychidae	X	.	.	X	.	.	.
Cheumatopsyche sp.	X	X	X	X	X	X	.
Hydropsyche sp.	X	.	.	.	X	.	.
Leptoceridae							
Oecetis sp.	.	X	.	.	.	.	.
Limnephilidae							
Pycnopsyche sp.	.	.	.	.	.	X	.
Philapotamidae							
Chimarra sp.	X	.	.	.	.	.	.
Megaloptera							
Corydalidae							
Corydalus cornutus	X	X	X	X	X	X	.
Sialidae							
Sialis sp.	X	X	.	X	X	.	.
Diptera							
Chironomidae	.	.	X	X	X	.	.
Ablabesmyia mallochi	.	.	.	X	X	.	.
Chironomus sp.	.	.	.	.	.	.	X
Cladotanytarsus sp.	.	.	.	.	.	X	.
Conchapelopia sp.	.	.	.	.	X	.	X
Cricotopus bicinctus	.	.	.	X	.	.	X
Crypyochironomus fulvus	.	.	.	X	X	.	X
Dicrotendipes sp.	.	.	.	X	.	.	.
Microtendipes sp.	.	X	.	.	.	X	.
Nanocladius sp.	X	.	.	.	X	.	.
Paratendipes sp.	.	X	.	.	.	.	X
Polypedilum sp.	X	.	.	.	X	.	.

Table C-15.2b List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, July 1997

Taxon	Big Bywy Ditch @ Hwy. 9	Big Bywy Ditch @ Hwy. 15	Middle Bywy Creek @ Natchez Trace Pkwy.	Middle Bywy Creek @ Bywy Rd.	Middle Bywy Creek @ Hwy. 9	Middle Bywy Creek @ Prewitt Rd.	Jenkins Creek @ Chapel Hill Rd.
Polypedilum convictum	X	X	X	.	X	X	.
Polypedilum fallax	.	.	.	.	.	.	X
Polypedilum halterale	X	X	.	.	X	X	.
Polypedilum illinoense	.	X	X	.	.	X	X
Pseudochironomus sp.	.	.	.	.	.	X	.
Rheocricotopus sp.	X	.	.	.	.	.	.
Rheotanytarsus sp.	X	.	X	.	X	.	X
Stenochironomus sp.	.	.	.	X	.	.	.
Stictochironomus sp.	X	.	.	.	.	.	.
Tanytarsus sp.	X	.	.	X	.	.	X
Thienemanniella xena	X	.	.	.	.	.	.
Thienemannimyia sp.	.	X	.	X	X	.	.
Xylotopus par	.	.	.	X	.	.	.
Dixidae							
Dixa sp.	.	.	.	.	.	.	X
Dixella sp.	.	X	.	.	.	.	.
Culicidae							
Anopheles sp.	.	.	.	.	X	.	.
Emphididae							
Hemerodromia sp.	.	.	.	.	.	X	.
Simuliidae							
Simulium sp.	X	X	X	X	X	X	.
Tabanidae	.	.	X	.	.	.	.
Chrysops sp.	.	.	.	.	.	X	.
Tipulidae							
Limnophila sp.	.	.	.	.	X	.	.
Tipula sp.	.	.	.	.	X	.	.
Coleoptera							
Curculionidae	.	X	.	.	.	.	.
Dryopidae							
Helichus basalis	.	X	X	X	X	.	X
Helichus lithophilus	X	.	X	X	X	X	X
Dytiscidae	X	X	X	X	X	.	X
Hydroporus sp.	.	X	X	.	X	X	X
Elmidae							
Ancyronyx variegatus	X	.	.	X	.	.	.
Dubiraphia sp.	X	X	.	.	X	.	.
Macronychus glabratus	X	.	X	X	X	X	X
Stenelmis sp.	X	X	X	X	X	.	.
Gyrinidae							
Dineutus sp.	X	X	X	X	.	X	.
Gyrinus sp.	.	.	X	.	.	X	.
Haliplidae							
Peltodytes sp.	.	X	.	.	.	.	.
Hydrophilidae							
Berosus sp.	.	X	.	.	.	.	.

Table C-15.2b List of Benthic Macroinvertebrate Taxa Found (X) in Streams in the Vicinity of the Proposed Red Hills Power Project, July 1997

Taxon	Big Bywy Ditch @ Hwy. 9	Big Bywy Ditch @ Hwy. 15	Middle Bywy Creek @ Natchez Trace Pkwy.	Middle Bywy Creek @ Bywy Rd.	Middle Bywy Creek @ Hwy. 9	Middle Bywy Creek @ Prewitt Rd.	Jenkins Creek @ Chapel Hill Rd.
Arachnoidea							
Acariformes	.	X	.	.	.	.	.
Gastropoda							
Mesogastropoda							
Plueroceridae							
Leptoxis praerosa	.	.	.	X	.	.	.
Bivalvia							
Unionoida							
Unionidae	X	.	.	.	.	.	.
Veneroida							
Corbiculidae							
Corbicula fluminea	X	.	.	.	.	.	.
Number of taxa	41	40	32	37	44	28	29
Number of EPT taxa	14	12	9	12	11	7	3

Table C-15.3 Crayfish Species Lists from Streams in the Vicinity of the Proposed Red Hills Power Project Area, April 1997 (Identifications by J. F. Fitzpatrick, Jr., University of South Alabama)

Species	Big Bywy Ditch @ Hwy. 15	Big Bywy Ditch @ Hwy. 9	Big Bywy Ditch @ Chester-Tomnolen Rd.	Swamp, Big Bywy Ditch @ Hebron Rd.
O. (*Trisellescens*) sp., ref.: *etnieri*				
Procambarus (Ortmannicus) acutus	X			
P. (O.) acutus var.		X		X
P. (Pennides) vioscai paynei	X		X	
	Middle Bywy Creek @ Hwy. 9	Middle Bywy @ Prewitt Rd.	Middle Bywy Creek @ Natchez Trace	Middle Bywy Creek @ Bywy Rd.
O. (Trisellescens) sp., ref.: *etnieri*	X			
Procambarus (Ortmannicus) acutus		X	X	
P. (Pennides) vioscai paynei	X	X		
	Besa Chitto Creek @ Hwy. 9	Besa Chitto @ Stewart Rd.	Stewart Creek @ Sturgis-Reform Rd.	Log Branch @ Prewitt Rd.
Cambarus (Depressicambarus) striatus	X			
Orconectes (Buannnulifictus) hobbsi		X		
O. (Trisellescens) sp., ref.: *etnieri*			X	
Procambarus (Ortmannicus) acutus		X	X	X
P. (O.) acutus var.	X			
P. (O.) hybus	X			
P. (Pennides) vioscai paynei			X	X
	Jenkins Creek @ Chapel Hill Rd.	Little Bywy Creek @ Salem-Bywy Rd.	Little Bywy Creek @ Natchez Trace	Bowie Branch @ Hwy. 415
O. (Trisellescens) sp., ref.: *etnieri*		X		X
Procambarus (Ortmannicus) acutus				X
P. (Pennides) vioscai paynei	X		X	X
	McCurtain Creek @ Watson-Bankston Rd.	McCurtain Creek @ Talley Rd.		
Cambarus (Depressicambarus) striatus	X			
O. (Trisellescens) sp., ref.: *etnieri*	X			
P. (Pennides) vioscai paynei	X	X		

Table C-15.4 Crayfish Species Lists from Streams in the Vicinity of Proposed Transmission Line Corridors, June 1997 (Identifications by J. F. Fitzpatrick, Jr., University of South Alabama)

Species	Sand Creek@ New Substation	Horse Creek @ Wood Rd.	Trib. to Boughenia Creek @ Hwy. 12, RR Trestle	Trib. to Boughenia Creek @ Hwy. 12 E. of Fulcher
Cambarus (Depressicambarus) striatus			X	
Orconectes (Trisellescens) sp., ref.: *etnieri*		X	X	
Procambarus (Ortmannicus) acutus var.				X
P. (O.) acutissimus	X			
P. (O.) viaeviridis	X			
P. (Pennides) vioscai paynei	X	X	X	

Species	Trib. To Bogue Fallah @ Hwy. 12 W. of Bethlehem	Trib. to Yockanookany River @ Hwy. 12	Yockanookany River @ Hwy. 9
Cambarus (Depressicambarus) striatus	X		X
Orconectes (Hespericambaras) hartfieldi			X
O. (Trisellescens) sp., ref.: *etnieri*	X		
Procambarus (Ortmannicus) acutus			X
P. (O.) acutus var.		X	X
P. (Pennides) vioscai paynei			X

Species	Trib. to Yockanookany River @ Hwy. 415	Trib. to Yockanookany River @ Mabus Rd.	Besa Chitto @ Sanders Rd.
Cambarus (Depressicambarus) striatus		X	
C. (Lacunicambarus) diogenes	X		
Procambarus (Ortmannicus) acutus var.	X	X	X
P. (Pennides) vioscai paynei			X

Table C-15.5 List of Fish Families, Common Names, and Scientific Names Encountered in Surveys of Streams in the Vicinity of the Proposed RHPP, Choctaw County, Missisippi, April 1997

Family	Common Name	Scientific Name
Petromyzontidae--lampreys	Chestnut lamprey	*Ichthyomyzon castaneus*
	Southern brook lamprey	*I. gagei*
Lepisosteidae--gars	Spotted gar	*Lepisosteus occulatus*
Amiidae--bowfin	Bowfin	*Amia calva*
Clupeidae--herrings	Gizzard shad	*Dorosoma cepedianum*
Cyprinidae--minnows	Bluntface shiner	*Cyprinella camura*
	Blacktail shiner	*C. venusta*
	Striped shiner	*Luxilus chrysocephalus*
	Cherryfin shiner	*Lythrurus roseipinnis*
	Redfin shiner	*L. umbratilis*
	Bluehead chub	*Nocomis leptocephalus*
	Golden shiner	*Notemigonus crysoleucas*
	Silverband shiner	*Notropis shumardi*
	Weed shiner	*N. texanus*
	Pugnose minnow	*Opsopoeodus emiliae*
	Bluntnose minnow	*Pimephales notatus*
	Bullhead minnow	*P. vigilax*
	Creek chub	*Semotilus atromaculatus*
Catostomidae--suckers	Lake chubsucker	*Erimyzon succeta*
	Creek chubsucker	*E. oblongus*
	Spotted sucker	*Minytrema melanops*
	Blacktail redhorse	*Moxostoma poecilurum*
Ictaluridae--catfishes	Black bullhead	*Ameiurus melas*
	Yellow bullhead	*A. natalis*
	Blue catfish	*Ictalurus furcatus*
	Channel catfish	*I. punctatus*
	Least madtom	*Noturus hilderbrandi*
	Brindled madtom	*N. miurus*
	Brown madtom	*N. phaeus*
Esocidae--pikes	Grass pickerel	*Esox americanus*
Aphrododeridae--pirate perch	Pirate perch	*Aphrododerus sayanus*
Fundulidae--topminnows	Blackstripe topminnow	*Fundulus notatus*
	Blackspotted topminnow	*F. olivaceus*
Poeciliidae--livebearers	Mosquitofish	*Gambusia affinis*
Atherinidae--silversides	Brook silversides	*Labidesthes sicculus*
Centrarchidae--sunfishes	Flier	*Centrarchus macropterus*
	Banded pygmy sunfish	*Elassoma zonatum*
	Redbreast sunfish	*Lepomis auritus*
	Green sunfish	*L. cyanellus*
	Warmouth	*L. gulosus*
	Bluegill	*L. macrochirus*
	Dollar sunfish	*L. marginatus*
	Longear sunfish	*L. megalotis*
	Redear sunfish	*L. microlophus*
	Redspotted sunfish	*L. miniatus*
	hybrid sunfish	
	Spotted bass	*Micropterus punctulatus*
	Largemouth bass	*M. salmoides*
	White crappie	*Pomoxis annularis*
	Black crappie	*P. nigromaculatus*
Percidae--perches	Naked sand darter	*Ammocrypta beani*

Table C-15.5 List of Fish Families, Common Names, and Scientific Names Encountered in Surveys of Streams in the Vicinity of the Proposed RHPP, Choctaw County, Missisippi, April 1997		
Family	Common Name	Scientific Name
	Scaly sand darter	*A. vivax*
	Slough darter	*Etheostoma gracile*
	Harlequin darter	*E. histrio*
	Brighteye darter	*E. lynceum*
	Johnny darter	*E. nigrum*
	Goldstripe darter	*E. parvipinne*
	Cypress darter	*E. proliere*
	Speckled darter	*E. stigmaeum*
	Gulf darter	*E. swaini*
	Blackside darter	*Percina maculata*
	Dusky darter	*P. sciera*
Sciaenidae--drums	Freshwater drum	*Aplodinotus grunniens*

Table C-15.6 List of Fish Families, Common Names, and Scientific Names Encountered in Surveys of Streams That Would Be Crossed by the Proposed Transmission Line Corridor A		
Family	Common Name	Scientific Name
Petromyzontidae--lampreys	Least brook lamprey	*Lampetra aepyptera*
Cyprinidae—minnows	Blacktail shiner	*Cyprinella venusta*
	Silverjaw minnow	*Ericymba buccata*
	Striped shiner	*Luxilus chrysocephalus*
	Pretty shiner	*Lythrurus bellus*
	Cherryfin shiner	*Lythrurus roseipinnis*
	Bluehead chub	*Nocomis leptocephalus*
	Golden shiner	*Notemigonus crysoleucas*
	Orangefin shiner	*Notropis ammophilus*
	Weed shiner	*N. texanus*
	Clear shiner	*Notropis winchelli*
	Pugnose minnow	*Opsopoeodus emiliae*
	Rough shiner	*Notropis baileyi*
	Bluntnose minnow	*Pimephalles notatus*
	Creek chub	*Semotilus atromaculatus*
Catastomidae--suckers	Creek chubsukcker	*Erimyzon oblongus*
Ictaluridae—catfishes	Yellow bullhead	*A. natalis*
	Tadpole madtom	*Noturus gyyrinus*
	Speckled madtom	*Noturus leptacanthus*
	Freckled madtom	*Noturus noctukrnus*
Esocidae—pikes	Grass pickerel	*Esox americanus*
Aphrododeridae--pirate perch	Pirate perch	*Aphrododerus sayanus*
Fundullidae—topminnows	Blackstripe topminnow	*Fundulus notatus*
	Blackspotted topminnow	*F. olivaceus*
Poeciliidae—livebearers	Mosquitofish	*Gambusia afinis*
Centrarchidae—sunfishes	Shadow bass	*Ambloplites ariommus*
	Banded pygmy sunfish	*Elassoma zonatum*
	Green sunfish	*Lepomis cyanellus*
	Warmouth	*L. gulosus*
	Bluegill	*L. macrochirus*
	Dollar sunfish	*L. marginatus*
	Longear sunfish	*L. megalotis*
	Redspotted sunfish	*L. miniatus*
	Spotted bass	*Micropterus punctulatus*

Table C-15.6 List of Fish Families, Common Names, and Scientific Names Encountered in Surveys of Streams That Would Be Crossed by the Proposed Transmission Line Corridor A

Family	Common Name	Scientific Name
	Largemouth bass	*M. salmoides*
Percidae--perches	Southern sand darter	*Ammocrypta meridiana*
	Bluntnose darter	*Etheostoma chlorosomum*
	Harlequin darter	*E. histrio*
	Tombigbee darter	*E. lachneri*
	Johnny darter	*E. nigrum*
	Goldstripe darter	*E. parvipinne*
	Cypress darter	*E. stigmaeum*
	Gulf darter	*E. swaini*
	Redfin darter	*E. whipplei*
	Blackbanded darter	*Percina nigrofasciata*
	Dusky darter	*Percina sciera*

Table C-15.7 Species and Numbers of Fish Collected in Besa Chitto Creek at Station Number 17

Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Cherryfin shiner	*Lythrurus roseipinnis*	112	202	
Golden shiner	*Notemigonus crysoleucas*	10	17	
Pugnose minnow	*Opsopoeodus emiliae*	2	2	
Bluntnose minnow	*Pimephales notatus*	8	16	
Creek chub	*Semotilus atromaculatus*	3	5	
Creek chubsucker	*Erimyzon oblongus*	6	7	
Yellow bullhead	*Ameiurus natalis*	1	1	
Pirate perch	*Aphredoderus sayanus*	1	1	
Blackspotted topminnow	*Fundulus olivaceus*	12	22	
Mosquitofish	*Gambusia affinis*	1	1	
Banded pygmy sunfish	*Elassoma zonatum*	1	1	
Green sunfish	*Lepomis cyanellus*	7	9	
Warmouth	*L. gulosus*	2	2	
Bluegill	*L. macrochirus*	3	15	in bag
Dollar sunfish	*L. marginatus*	10	10	in bag
Longear sunfish	*L. megalotis*	3	17	in bag
Redear sunfish	*L. microlophus*	1	2	in bag
Bluntnose darter	*Etheostoma chlorosomum*	26	34	
Cypress darter	*E. proeliare*	16	16	
Gulf darter	*E. swaini*	9	9	
TOTALS: 18 species	sampling units	234	389	

Table C-15.8 Species and Numbers of Fish Collected in Middle Bywy Creek at Station 9

Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Bluntface shiner	*Cyprinella camura*	93	117	
Striped shiner	*Luxilus chrysocephalus*	23	28	
Cherryfin shiner	*Lythrurus roseipinnis*	17	17	
Bluehead chub	*Nocomis leptocephalus*	1	1	
Bluntnose minnow	*Pimephales notatus*	25	35	
Creek chub	*Semotilus atromaculatus*	1	1	
Yellow bullhead	*Ameiurus natalis*	1	1	
Brindled madtom	*Noturus miurus*	3	9	
Brown madtom	*N. phaeus*	3	3	
Blackspotted topminnow	*Fundulus olivaceus*	5	5	
Green sunfish	*Lepomis cyanellus*	1	1	
Bluegill	*L. macrochirus*	1	1	
Longear sunfish	*L. megalotis*	5	5	
Brighteye darter	*Etheostoma lynceum*	5	28	
Speckled darter	*E. stigmaeum*	11	28	
Dusky darter	*Percina sciera*	5	7	
TOTALS: 16 species	sampling units	200	287	

Table C-15.9 Species and Numbers of Fish Collected in Jenkins Creek at Station 11

Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Southern brook lamprey	*Ichthyomyzon gagei*	2	2	immature
Striped shiner	*Luxilus chrysocephalus*	107	172	
Cherryfin shiner	*Lythrurus roseipinnis*	43	56	
Bluehead chub	*Nocomis leptocephalus*	11	12	
Bluntnose minnow	*Pimephales notatus*	53	75	
Bullhead minnow	*P. vigilax*	1	2	
Creek chub	*Semotilus atromaculatus*	2	5	
Creek chubsucker	*Erimyzon oblongus*	1	1	
Brown madtom	*Noturus phaeus*	4	5	
Pirate perch	*Aphredoderus sayanus*	1	1	
Blackspotted topminnow	*Fundulus olivaceus*	3	5	
Redbreast sunfish	*Lepomis auritus*	10	10	
Green sunfish	*L. cyanellus*	2	4	
Longear sunfish	*L. megalotis*	8	8	
Brighteye darter	*Etheostoma lynceum*	4	4	
Johnny darter	*E. nigrum*	4	7	
Goldstripe darter	*E. parvipinne*	42	310	
Cypress darter	*E. proeliare*	3	3	
Speckled darter	*E. stigmaeum*	5	9	
Dusky darter	*Percina sciera*	1	1	
TOTALS: 20 species	13 sampling units	307	692	

Table C-15.10 Species and Numbers of Fish Collected in McCurtain Creek at Station 16				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Southern brook lamprey	*Ichthyomyzon gagei*	1	1	immature
Bluntface shiner	*Cyprinella camura*	11	31	
Blacktail shiner	*C. venusta*	5	9	
Striped shiner	*Luxilus chrysocephalus*	6	8	
Golden shiner	*Notemigonus crysoleucas*	1	1	
Weed shiner	*Notropis texanus*	8	8	
Pugnose minnow	*Opsopoeodus emiliae*	6	7	
Bluntnose minnow	*Pimephales notatus*	20	23	
Bullhead minnow	*P. vigilax*	13	16	
Blacktail redhorse	*Moxostoma poecilurum*	1	1	
Brindled madtom	*N. miurus*	13	61	
Brown madtom	*N. phaeus*	1	1	
Grass pickerel	*Esox americanus*	2	5	
Pirate perch	*Aphrododerus sayanus*	2	2	
Blackspotted topminnow	*Fundulus olivaceus*	10	22	
Mosquitofish	*Gambusia affinis*	6	6	
Brook silversides	*Labidesthes sicculus*	3	3	
Banded pygmy sunfish	*Elassoma zonatum*	1	2	
Green sunfish	*Lepomis cyanellus*	1	1	
Warmouth	*L. gulosus*	1	1	
Bluegill	*L. macrochirus*	22	23	
Longear sunfish	*L. megalotis*	23	24	
Spotted bass	*Micropterus punctulatus*	2	2	
Largemouth bass	*M. salmoides*	0	1	
Naked sand darter	*Ammocrypta beani*	5	11	
Johnny darter	*Etheostoma nigrum*	15	19	
Cypress darter	*E. proeliare*	1	1	
Speckled darter	*E. stigmaeum*	16	19	
Dusky darter	*Percina sciera*	4	6	
TOTALS: 31 species	17 sampling units	200	315	

Table C-15.11 Species and Numbers of Fish Collected in Big Bywy Ditch at Station 1				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Bluntface shiner	*Cyprinella camura*	23	28	
Blacktail shiner	*C. venusta*	23	29	
Striped shiner	*Luxilus chrysocephalus*	9	9	
Cherryfin shiner	*L. roseipinnis*	97	97	
Redfin shiner	*L. umbratilis*	7	7	
Weed shiner	*Notropis texanus*	5	5	
Bluntnose minnow	*Pimephales notatus*	25	58	
Bullhead minnow	*P. vigilax*	2	2	
Blacktail redhorse	*Moxostoma poecilurum*	4	10	
Yellow bullhead	*Ameiurus natalis*	0	2	
Brindled madtom	*Noturus miurus*	8	10	
Brown madtom	*N. phaeus*	3	3	
Grass pickerel	*Esox americanus*	0	1	
Blackspotted topminnow	*Fundulus olivaceus*	15	21	
Mosquitofish	*Gambusia affinis*	2	2	
Warmouth	*Lepomis gulosus*	1	1	
Bluegill	*L. macrochirus*	5	9	
Dollar sunfish	*L. maarginatus*	1	1	in bag
Longear sunfish	*L. megalotis*	11	12	
Spotted bass	*Micropterus punctulatus*	1	7	
Scaly sand darter	*Ammocrypta vivax*	6	6	
Brighteye darter	*Etheostoma lynceum*	4	7	
Johnny darter	*E. nigrum*	11	16	
Speckled darter	*E. stigmaeum*	28	35	
Dusky darter	*Percina sciera*	6	11	
TOTALS: 24 species	19 sampling units	297	389	

Table C-15.12 Species and Numbers of Fish Collected in McCurtain Creek at Station 15				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Southern brook lamprey	*Ichthyomyzon gagei*	5	11	immature
Bluntface shiner	*Cyprinella camura*	20	25	
Blacktail shiner	*C. venusta*	0	3	
Striped shiner	*Luxilus chrysocephalus*	1	1	
Cherryfin shiner	*Lythrurus. roseipinnis*	19	19	
Golden shiner	*Notemigonus crysoleucas*	1	1	
Weed shiner	*Notropis texanus*	7	7	
Pugnose minnow	*Opsopoeodus emiliae*	3	3	
Bluntnose minnow	*Pimephales notatus*	1	1	
Brindled madtom	*Noturus miurus*	4	18	
Brown madtom	*N. phaeus*	1	2	
Grass pickerel	*Esox americanus*	1	1	
Blackspotted topminnow	*Fundulus olivaceus*	2	2	
Mosquitofish	*Gambusia affinis*	1	1	
Banded pygmy sunfish	*Elassoma zonatum*	3	3	
Green sunfish	*Lepomis cyanellus*	1	1	
Warmouth	*L. gulosus*	4	4	
Bluegill	*L. macrochirus*	3	4	
Longear sunfish	*L. megalotus*	1	2	
Naked sand darter	*Ammocrypta beani*	3	5	
Brighteye darter	*Etheostoma lynceum*	4	6	
Speckled darter	*E. stigmaeum*	3	3	
Dusky darter	*Percina sciera*	3	3	
TOTALS: 23 species	16 sampling units	92	125	

Table C-15.13 Species and Numbers of Fish Collected in Middle Bywy Creek at Station 10				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Bluntface shiner	*Cyprinella camura*	84	126	
Blacktail shiner	*C. venusta*	1	1	
Striped shiner	*Luxilus chrysocephalus*	8	51	
Cherryfin shiner	*Lythrurus. roseipinnis*	44	125	
Redfin shiner	*L. umbratilis*	31	31	
Bluntnose minnow	*Pimephales notatus*	16	83	
Bullhead minnow	*P. vigilax*	2	2	
Blacktail redhorse	*Moxostoma poecilurum*	1	2	
Least madtom	*Noturus hildebrandi*	5	5	
Brindled madtom	*N. miurus*	2	7	
Brown madtom	*N. phaeus*	2	2	
Blackspotted topminnow	*Fundulus olivaceus*	5	20	
Green sunfish	*Lepomis cyanellus*	1	1	
Bluegill	*L. macrochirus*	2	2	
Longear sunfish	*L. megalotis*	8	10	
Spotted sunfish	*L. punctatus*	1	2	in bag
Spotted bass	*Micropterus punctulatus*	1	4	
Naked sand darter	*Ammocrypta beani*	3	3	
Brighteye darter	*Etheostoma lynceum*	4	4	
Johnny darter	*E. nigrum*	1	1	
Goldstripe darter	*E. parvipinne*	7	11	
Speckled darter	*E. stigmaeum*	8	14	
~~Dusky darter~~	*Percina sciera*	1	1	
TOTALS: 23 species	16 sampling units	238	508	

Table C-15.14 Species and Numbers of Fish Collected in Middle Bywy Creek at Station 6

Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Striped shiner	*Luxilus chrysocephalus*	22	22	
Cherryfin shiner	*Lythrurus roseipinnis*	32	32	
Redfin shiner	*L. umbratilis*	18	18	in bag
Bluehead chub	*Nocomis leptocephalus*	1	1	
Golden shiner	*Notemigonus crysocephalus*	2	2	
Bluntnose minnow	*Pimephales notatus*	29	29	
Creek chub	*Semotilus atromaculatus*	1	2	
Blacktail redhorse	*Moxostoma poecilurum*	0	1	
Yellow bullhead	*Amieurus natalis*	1	2	
Brown madtom	*Noturus phaeus*	6	6	
Pirate perch	*Aphredoderus sayanus*	3	5	
Blackspotted topminnow	*Fundulus olivaceus*	10	21	
Green sunfish	*Lepomis cyanellus*	1	2	
Bluegill	*L. macrochirus*	3	12	
Longear sunfish	*L. megalotis*	9	11	
Redear sunfish	*L. microlophus*	0	1	
Brighteye darter	*Etheostoma lynceum*	2	2	
Johnny darter	*E. nigrum*	8	8	
Speckled darter	*E. stigmaeum*	12	22	
TOTALS: 19 species	21 sampling units	160	199	

Table C-15.15 Species and Numbers of Fish Collected in Besa Chitto Creek at Station 18

Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Striped shiner	*Luxilus chrysocephalus*	1	1	
Golden shiner	*Notemigonus crysoleucas*	1	1	
Creek chubsucker	*Erimyzon oblongus*	1	1	
Black bullhead	*Ameiurus melas*	1	1	
Yellow bullhead	*A. natalis*	1	1	
Mosquitofish	*Gambusia affinis*	1	1	
Dollar sunfish	*Lepomis marginatus*	1	1	
Longear sunfish	*L. megalotis*	1	1	
Bluntnose darter	*Etheostoma chlorosomum*	5	6	
Gulf darter	*E. swaini*	2	2	
TOTALS: 10 species	12 sampling units	15	16	

Sampling hampered by beaver dams, deep water, and snakes.

Table C-15.16 Species and Numbers of Fish Collected in Little Bywy Creek at Station 12				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Striped shiner	*Luxilus chrysocephalus*	26	26	
Cherryfin shiner	*Lythrurus roseipinnis*	31	41	
Bluehead chub	*Nocomis leptocephalus*	7	10	
Bluntnose minnow	*Pimephales notatus*	12	12	
Creek chub	*Semotilus atromaculatus*	0	9	
Brindled madtom	*Noturus miurus*	1	1	
Brown madtom	*N. phaeus*	6	6	
Blackstripe topminnow	*Fundulus notatus*	1	1	
Blackspotted topminnow	*Fundulus olivaceus*	2	5	
Mosquitofish	*Gambusia affinis*	2	2	
Green sunfish	*Lepomis cyanellus*	2	4	
Longear sunfish	*L. megalotis*	3	3	
Largemouth bass	*Micropterus salmoides*	1	1	
Brighteye darter	*Etheostoma lynceum*	3	3	
Johnny darter	*E. nigrum*	10	13	
Cypress darter	*E. proeliare*	2	2	
Speckled darter	*E. stigmaeum*	6	27	
Blackside darter	*Percina maculata*	3	3	
Dusky darter	*Percina sciera*	2	4	
TOTALS: 19 species	24 sampling units	120	173	

Table C-15.17 Species and Numbers of Fish Collected in Little Bywy Creek at Station 14				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Southern brook lamprey	*Ichthyomyzon gagei*	3	3	immature
Bluntface shiner	*Cyprinella camura*	6	6	
Striped shiner	*Luxilus chrysocephalus*	12	12	
Cherryfin shiner	*Lythrurus roseipinnis*	22	22	
Bluehead chub	*Nocomis leptocephalus*	2	2	
Bluntnose minnow	*Pimephales notatus*	5	5	
Creek chub	*Semotilus atromaculatus*	0	2	
Brindled madtom	*Noturus miurus*	2	11	
Brown madtom	*N. phaeus*	2	2	
Spotted bass	*Micropterus punctulatus*	0	1	
Brighteye darter	*Etheostoma lynceum*	2	4	
Johnny darter	*E. nigrum*	4	4	
Speckled darter	*E. stigmaeum*	5	13	
Dusky darter	*Percina sciera*	4	9	
TOTALS: 15 species	21 sampling units	69	96	

Table C-15.18 Species and Numbers of Fish Collected in Stewart Creek at Station 2				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Striped shiner	*Luxilus chrysocephalus*	43	78	
Cherryfin shiner	*Lythrurus roseipinnis*	104	110	
Golden shiner	*Notemigonus crysoleucas*	1	1	
Bluntnose minnow	*Pimephales notatus*	23	64	
Creek chub	*Semotilus atromaculatus*	7	10	
Creek chubsucker	*Erimyzon oblongus*	1	1	
Brown madtom	*Noturus phaeus*	2	2	
Blackspotted topminnow	*Fundulus olivaceus*	2	2	
Bluegill	*Lepomis macrochirus*	1	1	
Longear sunfish	*L. megalotis*	4	5	
Johnny darter	*Etheostoma nigrum*	3	4	
Speckled darter	*E. stigmaeum*	6	8	
TOTALS: 12 species	20 sampling units	197	286	

Table C-15.19 Species and Numbers of Fish Collected in Log Branch at Station 8				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Bluntface shiner	*Cyprinella camura*	1	1	
Striped shiner	*Luxilus chrysocephalus*	19	24	
Cherryfin shiner	*Lythrurus roseipinnis*	17	17	
Golden shiner	*Notemigonus crysoleucas*	4	4	
Bluntnose minnow	*Pimephales notatus*	5	5	
Creek chubsucker	*Erimyzon oblongus*	10	11	
Yellow bullhead	*Ameiurus natalis*	1	1	
Pirate perch	*Aphrododerus sayanus*	3	3	
Blackspotted topminnow	*Fundulus olivaceus*	12	21	
Mosquitofish	*Gambusia affinis*	1	2	
Green sunfish	*Lepomis cyanellus*	7	7	
Bluegill	*L. macrochirus*	8	8	
Longear sunfish	*L. megalotis*	5	5	
Redear sunfish	*L. microlophus*	0	1	
Largemouth bass	*Micropterus salmoides*	1	1	
Johnny darter	*Etheostoma nigrum*	4	4	
Goldstripe darter	*E. parvipinne*	5	5	
Cypress darter	*E. proeliare*	5	5	
Speckled darter	*E. stigmaeum*	5	5	
Dusky darter	*Percina sciera*	2	3	
TOTALS: 20 species	11 sampling units	115	133	

Table C-15.20 Species and Numbers of Fish Collected in Bowie Branch at Station 13				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Southeern brook lamprey	*Ichthyomyzon gagei*	3	8	immature
Bluntface shiner	*Cyprinella camura*	2	2	
Striped shiner	*Luxilus chrysocephalus*	35	74	
Cherryfin shiner	*Lythrurus roseipinnis*	73	73	
Bluehead chub	*Nocomis leptocephalus*	7	7	
Bluntnose minnow	*Pimephales notatus*	30	39	
Creek chub	*Semotilus atromaculatus*	1	1	
Creek chubsucker	*Erimyzon oblongus*	0	1	
Brown madtom	*Noturus phaeus*	3	8	
Blackspotted topminnow	*Fundulus olivaceus*	5	15	
Green sunfish	*Lepomis cyanellus*	1	1	
Warmouth	*L. gulosus*	0	1	
Longear sunfish	*L. megalotis*	3	3	
Brighteye darter	*Etheostoma lynceum*	5	6	
Johnny darter	*E. nigrum*	9	11	
Goldstripe darter	*E. parvipinne*	10	10	
Cypress darter	*E. proeliare*	3	12	
Speckled darter	*E. stigmaeum*	7	13	
Dusky darter	*Percina sciera*	1	2	
TOTALS: 19 species	18 sampling units	198	287	

Table C-15.21 Species and Numbers of Fish Collected in Big Bywy Creek at Station 5				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Chestnut lamprey	*Ichthyomyzon castaneus*	1	1	
Spotted gar	*Lepisosteus occulatus*	0	4	
Bowfin	*Amia calva*	0	3	photo
Gizzard shad	*Dorosoma cepedianum*	3	3	
Bluntface shiner	*Cyprinella camura*	1	1	
Blacktail shiner	*C. venusta*	20	20	
Striped shiner	*Luxilus chrysocephalus*	1	2	
Cherryfin shiner	*Lythrurus roseipinnis*	2	2	
Golden shiner	*Notemigonus crysoleucas*	2	2	
Silverband shiner	*Notropis shumardi*	2	2	in bag
Weed shiner	*N. texanus*	4	4	
Pugnose minnow	*Opsopoeodus emiliae*	8	8	
Bluntnose minnow	*Pimephales notatus*	1	1	
Bullhead minnow	*P. vigilax*	7	7	
Spotted sucker	*Minytrema melanops*	2	14	
Blacktail redhorse	*Moxostoma poecilurum*	7	64	
Yellow bullhead	*Ameiurus natalis*	0	2	
Channel catfish	*Ictalurus punctatus*	1	2	
Grass pickerel	*Esox americanus*	1	1	
Pirate perch	*Aphredoderus sayanus*	1	1	
Blackspotted topminnow	*Fundulus olivaceus*	3	11	
Mosquitofish	*Gambusia affinis*	3	4	
Brook silversides	*Labidesthes sicculus*	4	4	
Flier	*Centrarchus macropterus*	1	1	
Warmouth	*Lepomis gulosus*	2	3	
Bluegill	*L. macrochirus*	2	30	
Dollar sunfish	*L. marginatus*	0	4	
Longear sunfish	*L. megalotis*	12	12	
Redear sunfish	*L. microlophus*	1	2	
Spotted bass	*Micropterus punctulatus*	0	3	
Largemouth bass	*M. salmoides*	1	4	
White crappie	*Pomoxis annularis*	0	1	
Black crappie	*P. nigromaculatus*	2	4	
Freshwater drum	*Aplodinotus grunniens*	0	2	
TOTALS: 33 species	8 10-minute shocking runs	95	229	

Table C-15.22 Species and Numbers of Fish Collected in Big Bywy Ditch at Station 3				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Bluntface shiner	*Cyprinella camura*	95	98	
Blacktail shiner	*C. venusta*	80	134	
Striped shiner	*Luxilus chrysocephalus*	3	3	
Cherryfin shiner	*Lythrurus roseipinnis*	44	44	
Weed shiner	*Notropis texanus*	32	32	
Pugnose minnow	*Opsopoeodus emiliae*	2	2	
Bluntnose minnow	*Pimephales notatus*	33	33	
Bullhead minnow	*P. vigilax*	52	52	
Spotted sucker	*Minytrema melanops*	0	1	
Blacktail redhorse	*Moxostoma poecilurum*	3	4	
Blue catfish	*Ictalurus furcatus*	0	1	
Channel catfish	*I. punctatus*	0	1	
Brindled madtom	*Noturus miurus*	1	1	
Blackspotted topminnow	*Fundulus olivaceus*	21	21	
Mosquitofish	*Gambusia affinis*	12	53	
Green sunfish	*Lepomis cyanellus*	1	1	
Warmouth	*L. gulosus*	1	2	
Bluegill	*L. macrochirus*	0	1	
Longear sunfish	*L. megalotis*	10	12	
Spotted bass	*Micropterus punctulatus*	0	2	
White crappie	*Pomoxis annularis*	0	2	
Naked sand darter	*Ammocrypta beani*	8	8	
Scaly sand darter	*A. vivax*	2	2	
Brighteye darter	*Etheostoma lynceum*	3	3	
Johnny darter	*E. nigrum*	6	6	
Speckled darter	*E. stigmaeum*	14	15	
Gulf darter	*E. swaini*	2	2	
Dusky darter	*Percina sciera*	6	6	
TOTALS: 27 species	18 sampling units	431	542	

Table C-15.23 Species and Numbers of Fish Collected at Swamp, off Big Bywy Ditch at Station 4				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Blacktail shiner	*Cyprinella venusta*	6	6	
Golden shiner	*Notemigonus crysoleucas*	9	61	
Bluntnose minnow	*Pimephales notatus*	1	1	
Creek chub	*Semotilus atromaculatus*	1	1	
Lake chubsucker	*Erimyzon succeta*	1	1	
Black bullhead	*Ameiurus melas*	4	13	
Grass pickerel	*Esox americanus*	3	8	
Pirate perch	*Aphrododerus sayanus*	1	1	
Blackspotted topminnow	*Fundulus olivaceus*	4	12	
Mosquitofish	*Gambusia affinis*	6	11	
Flier	*Centrarchus macropterus*	3	7	
Banded pygmy sunfish	*Elassoma zonatum*	5	5	
Green sunfish	*Lepomis cyanellus*	1	1	
Warmouth	*L. gulosus*	2	13	
Bluegill	*L. macrochirus*	25	53	
Dollar sunfish	*L. marginatus*	32	51	
Longear sunfish	*L. megalotis*	0	7	
Redear sunfish	*L. microlophus*	6	6	
hybrid sunfish		2	2	
Largemouth bass	*Micropterus salmoides*	0	1	
Slough darter	*Etheostoma gracile*	2	2	
Gulf darter	*E. swaini*	5	6	
TOTALS: 20 species	30 sampling units	93	177	

Table C-15.24 Species and Numbers of Fish Collected in Middle Bywy Creek at Station 7				
Common Name	Scientific Name	Number of Specimens	Total Collected	Remarks
Bluntface shiner	*Cyprinella camura*	40	40	
Striped shiner	*Luxilus chrysocephalus*	23	23	
Cherryfin shiner	*Lythrurus roseipinnis*	17	17	
Redfin shiner	*L. umbratilis*	3	3	in bag
Bluehead chub	*Nocomis leptocephalus*	1	1	
Bluntnose minnow	*Pimephales notatus*	17	17	
Bullhead minnow	*P. vigilax*	1	1	
Creek chub	*Semotilus atromaculatus*	2	3	
Brindled madtom	*Noturus miurus*	14	52	
Brown madtom	*N. phaeus*	3	3	
Blackspotted topminnow	*Fundulus olivaceus*	6	7	
Bluegill	*Lepomis macrochirus*	1	1	
Harlequin darter	*Etheostoma histrio*	1	1	
Brighteye darter	*E. lynceum*	8	8	
Johnny darter	*E. nigrum*	2	2	
Speckled darter	*E. stigmaeum*	18	41	
Gulf darter	*E. swaini*	1	2	
Blackside darter	*Percina maculata*	2	2	
Dusky darter	*P. sciera*	8	23	
TOTALS: 19 species	19 sampling units	168	247	

Table C-15.25 Species and Numbers of Fish Collected from Proposed Transmission Line Corridor Crossing of Horse Branch at Wood Road			
Common Name	Scientific Name	Number of Specimens	Total Collected
Least brook lamprey	*Lampetra aepyptera*	6	9
Silverjaw minnow	*Ericymba buccata*	9	10
Striped shiner	*Luxilus chrysocephalus*	29	34
Pretty shiner	*Lythrurus bellus*	98	108
Bluehead chub	*Nocomis leptocephalus*	7	7
Golden shiner	*Notemigonus crysoleucas*	1	1
Orangefin shiner	*Notropis ammophilus*	43	43
Rough shiner	*N. baileyi*	201	201
Bluntnose minnow	*Pimephales notatus*	92	102
Creek chub	*Semotilus atromaculatus*	17	18
Creek chubsucker	*Erimyzon oblongus*	0	1
Tadpole madtom	*Noturus gyrinus*	2	2
Speckled madtom	*N. leptacanthus*	3	3
Freckled madtom	*N. nocturnus*	6	6
Blackspotted topminnow	*Fundulus olivaceus*	7	10
Green sunfish	*Lepomis cyanellus*	4	4
Warmouth	*L. gulosus*	1	1
Bluegill	*L. macrochirus*	3	4
Dollar sunfish	*L. marginatus*	0	2
Longear sunfish	*L. megalotis*	1	2
Harlequin darter	*Etheosotoma histrio*	1	1
Tombigbee darter	*E. lachneri*	48	48
Johnny darter	*E. nigrum*	25	25
Goldstripe darter	*E. parvipinne*	11	11
Cypress darter	*E. proeliare*	5	5
Speckled darter	*E. stigmaeum*	7	8
Redfin darter	*E. whipplei*	2	2
Blackbanded darter	*Percina nigrofasciata*	37	47
Dusky darter	*P. sciera*	2	2
TOTALS: 31 species	17 sampling units	668	717

Table C-15.26 Species and Numbers of Fish Collected from the Proposed Transmission Line Corridor Crossing of Sand Creek at the New Substation			
Common Name	Scientific Name	Number of Specimens	Total Collected
Least brook lamprey	*Lampetra aepyptera*	3	31
Blacktail shiner	*Cyprinella venusta*	6	6
Silverjaw minnow	*Ericymba buccata*	13	28
Striped shiner	*Luxilus chrysocephalus*	10	47
Pretty shiner	*Lythrurus bellus*	35	42
Bluehead chub	*Nocomis leptocephalus*	7	15
Orangefin shiner	*Notropis ammophilus*	50	50
Rough shiner	*N. baileyi*	167	410
Bluntnose minnow	*Pimephales notatus*	18	18
Creek chub	*Semotilus atromaculatus*	1	1
Speckled madtom	*Noturus leptacanthus*	14	14
Grass Pickerel	*Esox americanus*	1	3
Pirate perch	*Aphredoderus sayanus*	2	4
Blackspotted topminnow	*Fundulus olivaceus*	1	2
Shadow bass	*Ambloplites ariommus*	1	1
Banded pygmy sunfish	*Elassoma zonatum*	2	2
Green sunfish	*Lepomis cyanellus*	0	4
Warmouth	*L. gulosus*	0	1
Longear sunfish	*L. megalotis*	0	1
Largemouth bass	*Micropterus salmoides*	1	1
Southern sand darter	*Ammocrypta meridiana*	3	3
Tombigbee darter	*Etheostoma lachneri*	12	12
Johnny darter	*E. nigrum*	4	4
Speckled darter	*E. stigmaeum*	4	4
Blackbanded darter	*Percina nigrofasciata*	7	7
TOTALS: 25 species	19 sampling units	362	711

Table C-15.27 Species and Numbers of Fish Collected From Transmission Line Corridor at Unnamed Tributary to Boughenia Creek at MS Hwy. 12 Railroad Trestle			
Common Name	Scientific Name	Number of Specimens	Total Collected
Least brook lamprey	*Lampetra aepyptera*	2	2
Striped shiner	*Luxilus chrysocephalus*	2	15
Pretty shiner	*Lythrurus bellus*	50	162
Bluehead chub	*Nocomis leptocephalus*	1	6
Rough shiner	*Notropis baileyi*	9	9
Bluntnose minnow	*Pimephales notatus*	10	18
Creek chub	*Semotilus atromaculatus*	1	1
Creek chubsucker	*Erimyzon oblongus*	1	2
Yellow bullhead	*Ameiurus natalis*	1	1
Freckled madtom	*Noturus nocturnus*	1	1
Grass Pickerel	*Esox americanus*	0	1
Blackstripe topminnow	*Fundulus notatus*	1	1
Green sunfish	*Lepomis cyanellus*	1	2
Bluegill	*L. macrochirus*	0	6
Longear sunfish	*L. megalotis*	2	10
Redspotted sunfish	*L. miniatus*	1	2
Largemouth bass	*Micropterus salmoides*	0	7
Bluntnose darter	*Etheostoma chlorosomum*	1	1
Tombigbee darter	*E. lachneri*	1	1
Johnny darter	*E. nigrum*	9	10
Goldstripe darter	*E. parvipinne*	8	22
Cypress darter	*E. proeliare*	11	11
TOTALS: 22 species	22 sampling units	113	291

Table C-15.28 Species and Numbers of Fish Collected from Proposed Transmission Line Corridor at Unnamed Tributary to Boughenia Creek at MS 12 E. of Fulcher			
Common Name	Scientific Name	Number of Specimens	Total Collected
Striped shiner	*Luxilus chrysocephalus*	2	2
Bluehead chub	*Nocomis leptocephalus*	11	11
Creek chub	*Semotilus atromaculatus*	2	5
Creek chubsucker	*Erimyzon oblongus*	1	1
Mosquitofish	*Gambusia affinis*	4	10
Bluegill	*Lepomis macrochirus*	1	6
Goldstripe darter	*Etheostoma parvipinne*	6	7
TOTALS: 7 species	11 sampling units	27	42

Table C-15.29 Species and Numbers of Fish Collected from Transmission Line Corridor at Unnamed Tributary to Bogue Fallah at MS 12, 0.5 m West of Bethlehem Road			
Common Name	Scientific Name	Number of Specimens	Total Collected
Least brook lamprey	*Lampetra aepyptera*	1	1
Bluehead chub	*Nocomis leptocephalus*	3	10
Rough shiner	*Notropis baileyi*	16	173
Creek chub	*Semotilus atromaculatus*	2	3
Creek chubsucker	*Erimyzon oblongus*	2	4
Speckled madtom	*Noturus leptacanthus*	3	3
Green sunfish	*Lepomis cyanellus*	1	1
Bluegill	*L. macrochirus*	1	1
Goldstripe darter	*Etheostoma parvipinne*	4	17
Redfin darter	*E. whipplei*	2	2
Blackbanded darter	*Percina nigrofasciata*	1	1
TOTALS: 11 species	10 sampling units	36	216

Table C-15.30 Species and Numbers of Fish Collected from Transmission Line Corridor at Unnamed Tributary to Yockanookany River at MS 12, 0.5 m East of Ackerman			
Common Name	Scientific Name	Number of Specimens	Total Collected
Bluntnose minnow	*Pimephales notatus*	2	4
Blackspotted topminnow	*Fundulus olivaceus*	2	15
Mosquitofish	*Gambusia affinis*	1	6
Bluegill	*Lepomis macrochirus*	1	4
Goldstripe darter	*Etheostoma parvipinne*	3	9
TOTALS: 5 species	7 sampling units	9	38

Table C-15.31 Species and Numbers of Fish Collected from Transmission Line Corridor at Unnamed Tributary to Yockanookany River at Mabus Road			
Common Name	Scientific Name	Number of Specimens	Total Collected
Bluehead chub	*Nocomis leptocephalus*	1	1
Golden shiner	*Notemigonus crysoleucas*	3	8
Green sunfish	*Lepomis cyanellus*	1	2
Bluntnose darter	*Etheostoma chlorosomum*	2	2
Goldstripe darter	*E. parvipinne*	1	1
TOTALS: 5 species	8 sampling units	8	14

Table C-15.32 Species and Numbers of Fish Collected from Transmission Line Corridor at Unnamed Tributary to Yockanookany River at MS 415			
Common Name	Scientific Name	Number of Specimens	Total Collected
Cherryfin shiner	*Lythrurus roseipinnis*	2	4
Golden shiner	*Notemigonus crysoleucas*	1	3
Pugnose minnow	*Opsopoeodus emiliae*	1	1
Bluntnose minnow	*Pimephales notatus*	1	1
Creek chubsucker	*Erimyzon oblongus*	0	1
Pirate perch	*Aphrododerus sayanus*	3	3
Blackspotted topminnow	*Fundulus olivaceus*	3	3
Mosquitofish	*Gambusia affinis*	2	20
Warmouth	*Lepomis gulosus*	2	5
Bluegill	*L. macrochirus*	2	8
Longear sunfish	*L. megalotis*	1	2
Largemouth bass	*Micropterus salmoides*	0	5
Cypress darter	*Etheostoma proliere*	3	3
TOTALS: 13 species	7 sampling units	21	59

Table C-15.33 Species and Numbers of Fish Collected from Transmission Line Corridor at Besa Chitto Creek at Sanders Road			
Common Name	Scientific Name	Number of Specimens	Total Collected
Cherryfin shiner	*Lythrurus roseipinnis*	10	235
Golden shiner	*Notemigonus crysoleucas*	1	45
Weed shiner	*Notropis texanus*	10	11
Pugnose minnow	*Opsopoeodus emiliae*	5	30
Bluntnose minnow	*Pimephales notatus*	4	87
Creek chubsucker	*Erimyzon oblongus*	3	32
Grass Pickerel	*Esox americanus*	0	5
Blackspotted topminnow	*Fundulus olivaceus*	4	44
Mosquitofish	*Gambusia affinis*	1	3
Warmouth	*Lepomis gulosus*	0	1
Bluegill	*L. macrochirus*	0	3
Dollar sunfish	*L. marginatus*	2	2
Longear sunfish	*L. megalotis*	4	19
Bluntnose darter	*Etheostoma chlorosomum*	9	15
Cypress darter	*E. proeliare*	8	8
Gulf darter	*E. swaini*	1	2
TOTALS: 16 species	18 sampling units	62	542

Table C-15.34 Species and Numbers of Fish Collected from Transmission Line Corridor at Yockanoonany River at MS 9

Common Name	Scientific Name	Number of Specimens	Total Collected
Least brook lamprey	*Lampetra aepyptera*	1	1
Blacktail shiner	*Cyprinella venusta*	1	2
Clear chub	*Hybopsis winchelli*	15	15
Striped shiner	*Luxilus chrysocephalus*	1	2
Cherryfin shiner	*Lythrurus roseipinnis*	130	339
Weed shiner	*Notropis texanus*	26	53
Pugnose minnow	*Opsopoeodus emiliae*	9	9
Bluntnose minnow	*Pimephales notatus*	10	48
Creek chubsucker	*Erimyzon oblongus*	1	2
Speckled madtom	*Noturus leptacanthus*	9	9
Grass Pickerel	*Esox americanus*	1	2
Pirate perch	*Aphrododerus sayanus*	1	1
Blackspotted topminnow	*Fundulus olivaceus*	4	9
Mosquitofish	*Gambusia affinis*	3	9
Banded pygmy sunfish	*Elassoma zonatum*	1	1
Green sunfish	*Lepomis cyanellus*	0	1
Warmouth	*L. gulosus*	0	1
Bluegill	*L. macrochirus*	1	2
Longear sunfish	*L. megalotis*	17	93
Spotted bass	*Micropterus punctulatus*	0	1
Largemouth bass	*M. salmoides*	1	2
Bluntnose darter	*Etheostoma chlorosomum*	38	38
Goldstripe darter	*E. parvipinne*	8	8
Gulf darter	*E. swaini*	13	13
Blackbanded darter	*Percina nigrofasciata*	5	6
Dusky darter	*P. sciera*	1	1
TOTALS: 26 species	16 sampling units	297	668

Table C-15.35 Red Hills Project Area Mussel Collection Results-Noxubee River Drainage

Species	Sand Cr. @ Louisville Rd. 24 July 1997	Sand Cr. @ Co. Line Rd. 24 July 1997	Horse Branch @ Wood Rd. 24 July 1997	Basin Totals
Lampsilis straminea		4		4
Strophitus radiatus		4		4
Villosa lienosa		2		2
Total mussels encountered	0	10	0	10
Species included	0	3	0	3

Table C-15.36 Red Hills Project Area Mussel Collection Results-Yockanookany River Drainage					
Species	Besa Chitto Cr. @ Weir 23 July 97	Besa Chitto Cr. @ Rt. 9 Apr 1997	Besa Chitto Cr. @ Rt. 9 22 Jul 97	Unnamed trib. @ Rt.9 3 June 97	Basin Totals
Elliptio arca		1	2	1	4
Lampsilis claibornensis	7			1	8
Villosa lienosa	4				10
Total mussels encountered	11	1	2	8	22
Species included	2	1	1	3	3

Table C-15.37 Red Hills Project Area Mussel Collection Results-Big Black River Drainage

Species	Big Bywy Ditch @ Rt. 9 10 Oct 96	Big Bywy Ditch @ Rt. 9 1 Apr 97	Big Bywy Ditch @ Rt. 9 22 Jul 97	Big Bywy Ditch @ Rt. 15 2 Apr 97	Big Bywy Ditch @ Rt. 15 22 Jul 97	McCurtin Cr. @ Tally Rd. 8 Apr 97	McCurtin Cr. @ Tally Rd. 24 Jul 97	McCurtin Cr. @ Watson-Bankston Rd. 24 Jul 97
Anodonta grandis				1				4
Fusconaia flava							5	9
Lampsilis siliquoidea	8		9		11	1	10	21
Potamilus purpuratus			1					
Quadrula quadrula							3	
Strophitus radiatus	2	1			8			
Toxolasma parvus			4		29			5
Toxolasma texasensis							2	
Uniomerus tetralasmus			1					
Villosa lienosa			1		8		1	6
Villosa sp.					6			
Total mussels encountered	10	1	16	1	62	1	21	45
Species included	2	1	5	1	5	1	5	5

Table C-15.38 Red Hills Project Area Mussel Collection Results-Big Black River Drainage

Species	Middle Bywy Cr. @ Bywy Rd. 22 Jul 97	Middle Bywy Cr. @ Natchez Trace Apr 97	Middle Bywy Cr. @ Natchez Trace 23 Jul 97	Jenkins Cr. @ Chapel Hill Rd. 23 Jul 97	Little Bywy Cr. @ Natchez Trace 23 Jul 97	Stewart Cr. @ Reform-Sturgis Rd. 22 Jul 97	Total Basins
Anodonta grandis							5
Fusconaia flava							14
Lampsilis siliquoidea	1	1	1		1		64
Potamilus purpuratus							1
Quadrula quadrula							3
Strophitus radiatus	2				4		17
Toxolasma parvus			1				39
Toxolasma texasensis							2
Uniomerus tetralasmus							1
Villosa lienosa					5		21
Villosa sp.							6
Total mussels encountered	3	1	2	0	10	0	173
Species included	2	1	2	0	3	0	11

Appendix C-16 Terrestrial Ecology - Vascular Plants

List of all vascular plants observed during spring, summer, and fall surveys at Red Hills Power Project Lands in Choctaw County, Mississippi.

Acalypha gracilens
Acer negundo
Acer rubrum
Adiantum pedatum
Aesculus pavia
*Agalinis fasciculata**
*Agalinis gattingeri**
Agalinis purpurea
Agalinis tenuifolia
Agave virginica
Agrimonia parviflora
Agrimonia rostellata
Agrostis elliottiana
Agrostis hyemalis
Ajuga reptans
Aira elegans
Albizia julibrissin
*Allium ampelophrasum**
Allium bivalve
Allium canadense
Allium cepa
Allium vineale
*Alnus serrulata**
Alopecurus carolinianus
Ambrosia artemisifolia
Amelanchier arborea
Amphicarpaea bracteata
Andropogon scoparius
Andropogon virginicus
Antennaria plantaginifolia
*Anthoxanthum odoratum**
Apios americana
Apocynum cannabinum
Aralia spinosa
Arenaria serpyllifolia
Arisaema dracontium
Arisaema quinatum
Arisaema triphyllum
*Aristida dichotoma**
*Aristida longespica**
Aristida oligantha
*Aristida purpurascens**
*Aristida ramosissima**
Aristolochia serpentaria
Arundinaria gigantea
Asclepias tuberosa
Asclepias variegata
Asimina triloba
Asplenium platyneuron
*Aster dumosus**
Aster exilis
*Aster hemisphericus**
*Aster lateriflorus**
Aster patens
Aster solidagineus
Athyrium asplenioides
Aureolaria flava
*Aureolaria pectinata**
Baccharis halimifolia
*Baptisia alba**
Berchemia scandens
*Bidens aristosa**
Bignonia capreolata
Blephilia ciliata
Boehmeria cylindrica
Boltonia diffusa
Botrychium biternatum
Botrychium virginianum
Brachyelytrum erectum
Brintonia discoidea
*Briza minor**
Bromus catharticus
Bromus commutatus
Bromus japonicus
Bromus secalinus
Brunnichia ovata
Cacalia atriplicifolia
Cacalia ovata
Calystegia sepium
Callicarpa americana
Calycocarpum lyonii
Campsis radicans
Cardamine hirsuta
Carex abscondita
Carex albicans
Carex albolutescens
Carex blanda

Carex bushii

Carex caroliniana

Carex cephalophora

Carex cherokeensis

Carex complanata

Carex crebriflora

Carex crinita

Carex debilis

Carex digitalis

Carex festucacea

Carex flaccosperma

Carex frankii

Carex hirsutula

Carex laxiflora

Carex leavenworthii

Carex longii

Carex lurida

Carex muhlenbergii

Carex nigromarginata

Carex oxylepis

Carex retroflexa

Carex rosea

Carex striatula

Carex triangularis

Carex tribuloides

Carex umbellata

Carex vulpinoidea

Carex willdenowii

Carpinus caroliniana

Carya carolinae-septentrionalis

Carya cordiformis

Carya glabra

Carya illinoensis

Carya leiodermis

Carya ovata

Carya pallida

Carya tomentosa

Cassia chamaecrista

*Cassia nictitans**

Castanea pumila

Catalpa bignonioides

Ceanothus americanus

Celtis laevigata

Cephalanthus occidentalis

Cerastium glomeratum

Cercis canadensis

Chaerophyluum tainturieri

Chamaelirium luteum

Chasmanthium latifolium

Chasmanthium sessiliflorum

Chelone glabra

Chrysopsis graminifolia

Circuta maculata

Cirsium horridulum

Claytonia virginica

Clematis virginiana

Cocculus carolinus

Commelina virginica

*Coreopsis grandiflora**

*Coreopsis tripteris**

Cornus florida

Cornus stricta

Corylus americana

Crataegus ashei

Cratagus crus-galli

Crataegus gattingeri

Crataegus marshallii

Crotalaria sagittalis

Croton capitatus

Cuscuta campestris

Cynodon dactylon

Cynoglossum virginianum

Cyperus echinatus

Cyperus haspan

Cyperus iria

Cyperus pseudovegetus

Danthonia sericea

Datura stramonium

Daucus carota

Decumaria barbara

Desmodium cuspidatum

Desmodium marilandicum

Desmodium nudiflorum

Desmodium pauciflorum

Desmodium perplexum

Desmodium rotundifolium

Desmodium viridiflorum

Dichondra carolinensis

Digitaria ciliaris

*Digitaria ischaemum**

Diodia teres

Dioscorea batatas

Dioscorea villosa

Diospyros virginiana

Eleocharis obtusa

Eleocharis tenuis

Elephantopus carolinianus

Elephantopus tomentosus
Elymus virginicus
Erechtites hieracifolia
Erianthus contortus
Erianthus giganteus
*Erianthus strictus**
Erigeron annuus
Erigeron canadensis
Erigeron philadelphicus
Erigeron strigosus
Eryngium prostratum
Euonymus americanus
Eupatorium capillifolium
Eupatorium coelestinum
Eupatorium fistulosum
Eupatorium hyssopifolium
Eupatorium incarnatum
Eupatorium maculatum
Eupatorium perfoliatum
Eupatorium X pinnatifidum
Eupatorium rotundifolium
Eupatorium rugosum
Eupatorium serotinum
Euphorbia corollata
Euphorbia nutans
Fagus grandifolia
Festuca elatior
Festuca octoflora
Fimbristylis autumnalis
*Fimbristylis decipiens**
Fraxinus americana
Fraxinus pennsylvanica
Galactia volubilis
Galium aparine
Galium circazans
Galium obtusum
Galium pedemontanum
Galium pilosum
Galium triflorum
Galium uniflorum
Gelsemium sempervirens
Geum canadense
Gentiana villosa
Geranium carolinianum
Geranium maculatum
Gladiolus gandavensis
Gleditsia triacanthos
Glyceria striata
Gnaphalium falcatum
Gnaphalium obtusifolium
Gnaphalium purpureum
Gnaphalium spicatum
Gratiola neglecta
Gratiola virginiana
Gymnopogon ambiguus
Habenaria clavellata
Habenaria lacera
Hamamelis virginiana
*Hedeoma hispida**
Hedyotis crassifolia
Hedyotis purpurea
*Helenium amarum**
Helenium autumnale
Helenium flexuosum
Helianthus angustifolius
Helianthus divaricatus
Helianthus microcephalus
Hemerocallis fulva
Hieracium gronovii
Hordeum pusillum
Hydrangea arborescens
Hydrangea quercifolia
Hypericum drummondii
Hypericum gymnanthum
Hypericum hypericoides
Hypericum mutilum
*Hypericum punctatum**
Hypericum stragulum
Hypericum walteri
Ilex decidua
Ilex longipes
*Ilex montana**
Ilex opaca
Impatiens capensis
Ipomoea pandurata
Itea virginica
Iris germanica
Juglans nigra
Juncus acuminatus
Juncus coriaceus
Juncus debilis
Juncus dichotomus
Juncus diffusissimus
Juncus effusus
Juncus elliottii
Juncus marginatus
Juncus nodatus
Juncus scirpoides
Juncus tenuis

Juncus validus
Juniperus virginiana
Krigia dandelion
Krigia oppositifolia
Krigia virginica
Lactuca floridana
Lechea tenuifolia
Leersia lenticularis
*Leersia oryzoides**
Leersia virginica
Lepidum virginicum
Lespedeza cuneata
Lespedeza hirta
*Lespedeza hirta X virginica**
Lespedeza intermedia
Lespedeza procumbens
Lespedeza repens
Lespedeza striata
Lespedeza virginica
*Liatris squarrulosa**
Ligustrum sinense
Lilium superbum
Linaria canadensis
Linaria texensis
Lindera benzoin
Lindernia dubia
Linum medium
Linum striatum
Liquidambar styraciflua
Liriodendron tulipifera
Lobelia cardinalis
Lobelia puberula
Lolium multiflorum

Lonicera japonica
Lonicera sempervirens
Ludwigia alternifolia
Ludwigia decurrens
*Ludwigia glandulosa**
Ludwigia palustris
Luzula bulbosa
Luzula echinata
Lycopus rubellus
*Lycoris radiata**
Lysimachia lanceolata
Magnolia acuminata
Magnolia virginiana
Matelea carolinensis
Matelea obliqua
Mecardonia acuminata
Melia azedarach
Melica mutica
Mikania scandens
Mimulus alatus
Mitchella repens
Modiola caroliniana
Monarda fistulosa
Monotropa hypopithys
Morus rubra
Myosotis macrosperma
Myrica cerifera
Narcissus poeticus
Nyssa biflora
Nyssa sylvatica
Obolaria virginica
Oenothera biennis
Oenothera laciniata

Oenothera linifolia
*Oenothera speciosa**
Onoclea sensibilis
Ophioglossum petiolatum
Opuntia humifusa
Osmunda cinnamomea
Osmunda regalis
Ostrya virginiana
Oxalis colorea
Oxalis dillenii
Oxalis florida
Oxalis stricta
Oxalis violacea
Oxydendrum arboreum
*Panax quinquefolia**
Panicum anceps
*Panicum angustifolium**
Panicum boscii
Panicum clandestinum
Panicum commutatum
Panicum depauperatum
Panicum dichotomiflorum
Panicum dichotomum
Panicum hians
Panicum lanuginosum
Panicum laxiflorum
Panicum lindheimeri
Panicum microcarpon
Panicum oligosanthes
Panicum polyanthes
Panicum ravenelii
*Panicum rigidulum**
Panicum scoparium

Panicum sphaerocarpum
Panicum villosssisum
Parthenocissus quinquefolia
Paspalum dilatatum
*Paspalum floridanum**
*Paspalum laeve**
*Paspalum urvillei**
Passiflora incarnata
Passiflora lutea
Paulownia tomentosa
Pedicularis canadensis
Penstemon laxiflorus
Penthorum sedoides
*Phalaris caroliniana**
*Phaseolus polystachios**
Philadelphus inodorus
Phlox divaricata
Phlox nivalis
*Phlox pilosa**
Phoradendron serotinum
Phryma leptostachya
Physalis virginiana
Physostegia virginiana
Phytolacca americana
Pinus echinata
Pinus taeda
Plantago lanceolata
Plantago rugelii
Plantago virginica
Platanus occidentalis
Pluchea camphorata
Poa annua
Poa autumnalis
Poa pratensis
Podophyllum peltatum
Polygala incarnata
Polygala mariana
Polygala nana
Polygala sanguinea
Polygala verticillata
Polygonatum biflorum
Polygonum pensylvanicum
*Polygonum persicaria**
Polygonum punctatum
Polygonum virginicum
Polymnia uvedalia
Polypodium polypodiodes
Polypremum procumbens
Polysticum acrostichoides
Potamogeton diversifolius
Potentilla simplex
Prenanthes altissima
Prunella vulgaris
*Prunus angustifolia**
*Prunus mexicana**
Prunus serotina
Pteridium aquilinum
Ptilimnium capillaceum
*Pueraria lobata**
Pycnanthemum albescens
Pyrropappus carolinianus
Pyrropappus multicaulis
Pyrus arbutifolia
Pyrus calleyrana
Quercus alba
Quercus coccinea
Quercus falcata
Quercus laurifolia
*Quercus margaretta**
Quercus marilandica
Quercus michauxii
Quercus nigra
Quercus pagoda
Quercus phellos
Quercus rubra
Quercus shumardii
Quercus stellata
Quercus velutina
Ranunculus pusillus
Ranunculus recurvatus
*Ranunculus sarduous**
Rhamnus caroliniana
Rhexia mariana
Rhexia virginica
Rhododendron canescens
Rhus copallina
Rhus glabra
Rhus radicans
Rhus toxicodendron
*Rhus vernix**
Rhynchospora globularis
Rhynchospora glomerata
*Rhynchospora inexpansa**
Rosa carolina
Rosa chinensis
Rubus argutus
Rubus betulifolius
Rubus flagellaris
Rubus trivialis

Rudbeckia hirta
Rudbeckia laciniata
Ruellia caroliniensis
*Rumex crispus**
Rumex hastatulus
*Sabatia angularis**
Sagina decumbens
Sagittaria australis
Salix nigra
Salvia lyrata
Sambucus canadensis
Sanicula canadensis
Sanicula gregaria
Sanicula smallii
Sassafras albidum
Saururus cernuus
Schrankia microphylla
Scirpus atrovirens
Scirpus cyperinus
Scirpus koilolepis
Scleria oligantha
Scleria triglomerata
Scutellaria elliptica
Scutellaria integrifolia
*Senecio anonymos**
Senecio glabellus
Sherardia arvensis
Sida rhombifolia
Silphium integrifolium
Sisyrinchium angustifolium
Sisyrinchium exile
Smilacina racemosa
Smilax bona-nox
Smilax glauca
*Smilax laurifolia**
Smilax pulverulenta
Smilax rotundifolia
Smilax smallii
Smilax tamnoides
Solanum ptycanthum
Solidago altissima
Solidago arguta
Solidago caesia
Solidago gigantea
*Solidago nemoralis**
Solidago odora
Solidago petiolaris
*Solidago rugosa**
*Sonchus asper**
*Sorghastrum nutans**
*Sorghum halepense**
*Specularia biflora**
Sphagnum subsecundum
Sphenopholis intermedia
Sphenopholis nitida
Sphenopholis obtusata
Spigelia marilandica
Spiranthes cernua
Spiranthes vernalis
Staphylea trifolia
Stipa avenacea
Stylisma humistrata
Stylosanthes biflora
Styrax americana
Styrax grandifolia
Taraxacum officinale
Tephrosia virginiana
Thalictum revolutum
Thaspium trifoliatum
Thelypteris hexagonoptera
Tilia caroliniana
Tipularia discolor
Trachelospermum difforme
Tridens flava
Tridens strictus
*Trifolium campestre**
*Trifolium dubium**
*Trifolium incarnatum**
*Trufolium lappaceum**
Trifolium repens
Trillium cuneatum
Trillium recurvatum
Tripsacum dactyloides
Typha angustifolia
Ulmus alata
Ulmus americana
Ulmus rubra
Uvularia floridana
Uvularia grandiflora
Uvularia sessilifolia
Vaccinium arboreum
Vaccinium elliottii
Vaccinium fuscatum
Vaccinium stamineum
Valerianella radiata
*Verbascum thapsus**
Verbena brasiliensis
Verbena canadensis
Verbesina virginica

Vernonia gigantea
Veronica arvensis
Veronica peregrina
*Viburnum nudum**
Viburnum rufidulum
Vicia angustifolia
Vicia caroliniana
Vicia dasycarpa
Vicia hirsuta
Vica minutiflora
Viola affinis
Viola palmata
Viola primulifolia
Viola rafinesquii
Viola walteri
Vitis aestivalis
Vitis cinera
Vitis rotundifolia
Vitis vulpina
Wisteria floribunda
Wisteria frutescens
Woodwardia areolata
Yucca aloifolia
*Yucca flaccida**

* Species found only outside study areas.

Nomenclature follows checklists of the plants of Mississippi by McDaniel (1996, 1997).

Appendix C-17 Terrestrial Ecology - Birds, Amphibians, and Reptiles

Table C-17.1 List of All Birds, Mammals, Amphibians, and Reptiles Observed during Spring and Summer Surveys at Red Hills Power Project Lands in Choctaw County, Mississippi

BIRDS	
Accipitridae	
Accipiter cooperii	Cooper's Hawk
Buteo lineatus	Red-shouldered Hawk
Buteo jamaicensis	Red-tailed Hawk
Circus cyaneus	Northern Harrier
Falco sparverius	American Kestrel
Alcedinidae	
Ceryle alcyon	Belted Kingfisher
Apodidae	
Chaetura pelagica	Chimney Swift
Ardeidae	
Ardea herodias	Great Blue Heron
Bubulcus ibis	Cattle Egret
Butorides virescens	Green Heron
Egretta caerulea	Little Blue Heron
Caprimulgidae	
Caprimulgus carolinensis	Chuck-will's-widow
Chordeiles minor	Common Nighthawk
Cathartidae	
Cathartes aura	Turkey Vulture
Coragyps atratus	Black Vulture
Charidridae	
Charadrius vociferus	Killdeer
Columbidae	
Zenaida macroura	Mourning Dove
Corvidae	
Corvus brachyrhynchos	American Crow
Cyanocitta cristata	Blue Jay
Cuculidae	
Coccyzus americanus	Yellow-billed Cuckoo
Coccyzus erythropthalmus	Black-billed Cuckoo
Emberizidae, subfamily Parulinae	
Dendroica discolor	Prairie Warbler
Dendroica dominica	Yellow-throated Warbler
Dendroica pinus	Pine Warbler
Geothlypis trichas	Common Yellowthroat
Helmitheros vermivorus	Worm-eating Warbler
Icteria virens	Yellow-breasted Chat
Limnothlypis swainsonii	Swainson's Warbler
Mniotilta varia	Black-and-white Warbler
Oporornis formosus	Kentucky Warbler
Parula americana	Northern Parula
Setophaga ruticilla	American Redstart
Wilsonia citrina	Hooded Warbler
Emberizidae, subfamily Thraupinae	
Piranga olivacea	Scarlet Tanager
Piranga rubra	Summer Tanager
Emberizidae, subfamily Cardinalinae	
Cardinalis cardinalis	Northern Cardinal

Table C-17.1 List of All Birds, Mammals, Amphibians, and Reptiles Observed during Spring and Summer Surveys at Red Hills Power Project Lands in Choctaw County, Mississippi

Guiraca caerulea	Blue Grosbeak
Passerina cyanea	Indigo Bunting
Spiza americana	Dickcissel
Emberizidae, subfamily Emberizinae	
Ammodramus savannarum	Grasshopper Sparrow
Carduelis trisitis	American Goldfinch
Junco hyemalis	Dark-eyed Junco
Melospiza melodia	Song Sparrow
Passerella iliaca	Fox Sparrow
Pipilo erythrophthalmus	Eastern Towhee
Spizella passerina	Chipping Sparrow
Spizella pusilla	Field Sparrow
Zonotrichia albicolis	White-throated Sparrow
Emberizidae, subfamily Icterinae	
Agelaius phoeniceus	Red-winged Blackbird
Icterus spurius	Orchard Oriole
Molothrus ater	Brown-headed Cowbird
Quiscalus quiscula	Common Grackle
Sternella magna	Eastern Meadowlark
Hirundinidae	
Hirundo rustica	Barn Swallow
Progne subis	Purple Martin
Stelgidopteryx serripennis	Northern Rough-winged Swallow
Laniidae	
Lanius ludovicianus	Loggerhead Shrike
Mimidae	
Dumetella carolinensis	Gray Catbird
Mimus polyglottos	Northern Mockingbird
Toxostoma rufum	Brown Thrasher
Muscicapidae	
Hylocichla mustelina	Wood Thrush
Polioptila caerulea	Blue-gray Gnatcatcher
Regulus calendula	Ruby-crowned Kinglet
Sialis sialis	Eastern Bluebird
Turdus migratorius	American Robin
Paridae	
Baeolophus bicolor	Tufted Titmouse
Poecile carolinensis	Carolina Chickadee
Phasianidae	
Colinus virginianus	Northern Bobwhite
Meleagris gallopavo	Wild Turkey
Picidae	
Colaptes auratus	Northern Flicker
Dryocopus pileatus	Pileated Woodpecker
Melanerpes carolinus	Red-bellied Woodpecker
Melanerpes erythrocephalus	Red-headed Woodpecker
Picoides pubescens	Downy Woodpecker
Picoides villosus	Hairy Woodpecker
Sphyrapicus varius	Yellow-bellied Sapsucker
Scolopacidae	
Capella gallinago	Common Snipe
Sittidae	
Sitta canadensis	Red-breasted Nuthatch
Strigidae	
Bubo virginianus	Great Horned Owl
Otus asio	Eastern Screech-Owl

Table C-17.1 List of All Birds, Mammals, Amphibians, and Reptiles Observed during Spring and Summer Surveys at Red Hills Power Project Lands in Choctaw County, Mississippi

Strix varia	Barred Owl
Sturnidae	
Sturnus vulgaris	European Starling
Trochilidae	
Archilochus colubris	Ruby-throated Hummingbird
Troglodytidae	
Thryothorus ludovicianus	Carolina Wren
Tyrannidae	
Contopus virens	Eastern Wood-Pewee
Empidonax virescens	Acadian Flycatcher
Myiarchus crinitus	Great Crested Flycatcher
Sayornis phoebe	Eastern Phoebe
Tyrannus tyrannus	Eastern Kingbird
Vireonidae	
Vireo flavifrons	Yellow-throated Vireo
Vireo griseus	White-eyed Vireo
Vireo olivaceus	Red-eyed Vireo
MAMMALS	
Canidae	
Canis latrans	Coyote
Urocyon cineroargenteus	Gray Fox
Vulpes vulpes	Red Fox
Castoridae	
Castor canadensis	Beaver
Cervidae	
Odocoileus virginianus	White-tailed Deer
Dasypodidae	
Dasypus novemcinctus	Nine-banded Armadillo
Didelphidae	
Didelphis virginiana	Opposum
Felidae	
Lynx rufus	Bobcat
Leporidae	
Sylvilagus aquaticus	Swamp Rabbit
Sylvilagus floridanus	Eastern Cottontail
Muridae	
Ondatra zibethicus	Muskrat
Peromyscus leucopus	White-footed Mouse
Reithrodontomys humulis	Eastern Harvest Mouse
Sigmodon hispidus	Hispid Cotton Rat
Mustelidae	
Mephitis mephitis	Stripped Skunk
Mustela frenata	Long-tailed Weasel
Mustela vison	Mink
Procyonidae	
Procyon lotor	Raccoon
Sciuridae	
Glaucomys volans	Northern Flying Squirrel
Sciurus carolinensis	Gray Squirrel
Tamias striatus	Eastern Chipmunk
Soricidae	
Blarina carolinensis	Southern Short-tailed Shrew
Sorex longirostris	Southeastern Shrew
Talpidae	
Scalopus aquaticus	Eastern Mole
Vespertilionidae	

Table C-17.1 List of All Birds, Mammals, Amphibians, and Reptiles Observed during Spring and Summer Surveys at Red Hills Power Project Lands in Choctaw County, Mississippi

Eptesicus fuscus	Big Brown Bat
Lasiurus borealis	Red Bat
Nycticeius humeralis	Evening Bat
Pipistrellus subflavus	Eastern Pipistrelle
AMPHIBIANS	
Bufonidae	
Bufo americanus	American Toad
Bufo woodhousei fowleri	Fowler's Toad
Hylidae	
Acris gryllus	Southern Cricket Frog
Hyla avivoca	Bird-voiced Treefrog
Hyla cinerea	Green Treefrog
Hyla gratiosa	Barking Treefrog
Hyla versicolor	Gray Treefrog
Pseudacris crucifer	Spring Peeper
Pseudacris nigrita nigrita	Southern Chorus Frog
Microhylidae	
Gastrophryne carolinensis	Eastern Narrow-mouthed Toad
Plethodontidae	
Desmognathus fuscus	Northern Dusky Salamander
Eurycea bislineata	Northern Two-lined Salamander
Eurycea longicauda guttolineata	Three-lined Salamander
Plethodon mississippi	Mississippi Slimy Salamander
Pseudotriton ruber vioscai	Southern Red Salamander
Ranidae	
Rana clamitans clamitans	Bronze Frog
Rana utricularia	Southern Leopard Frog
Salamandridae	
Notophthalmus viridescens viridescens	Red-Spotted Newt
REPTILES	
Columbridae	
Carphophis amoenus amoenus	Eastern Worm Snake
Coluber constrictor	Southern Black Racer
Diadophis punctatus	Southern Ringneck Snake
Elaphe guttata	Corn Snake
Elaphe obsoleta	Gray Rat Snake
Lampropeltis calligaster calligaster	Prairie Kingsnake
Lampropeltis getulus holbrooki	Speckled Kingsnake
Nerodia sipedon	Midland Water Snake
Opheodrys aestivus	Rough Green Snake
Thamnophis sirtalis sirtalis	Eastern Garter Snake
Emydidae	
Chrysemys scripta elegans	Red-eared Turtle
Kinosternum subrubrum	Eastern Mud Turtle
Terrapene carolina triunguis	Three-toed Box Turtle
Iguanidae	
Anolis carolinensis	Green Anole
Sceloporus undulatus	Fence Lizard
Lacertidae	
Cnemidophorus sexlineatus	Six-lined Racerunner
Scincidae	
Scincella laterale	Ground Skink
Eumeces inexpectatus	Southeastern Five-lined Skink
Viperidae	
Agkistrodon contorix contorix	Southern Copperhead
Agkistrodon piscivorous	Cottonmouth

Table C-17.2 Bird Species Found within the Proposed Red Hills Mine Site in Choctaw County, Mississippi Considered as Vulnerable by the Partners In Flight Program (Jones 1997)

Species	Concern Score*	Neotropical Migrant	Temperate Migrant	Permanent Resident
Swainson's Warbler	29	X		
Prothonotary Warbler	28	X		
Chuck-Wills-Widow	26	X		
Loggerhead Shrike (Winter)	26		X	
Yellow-billed Cuckoo	25	X		
Prairie Warbler	25	X		
American Kestrel	25			X
Field Sparrow (Winter)	25		X	
Field Sparrow (Breeding)	24		X	
Great-crested Flycatcher	24	X		
Wood Thrush	24	X		
Chimney Swift	24	X		
Loggerhead Shrike (Breeding)	24		X	
Orchard Oriole	23	X		
Eastern Wood Peewee	23	X		
Hooded Warbler	23	X		
Kentucky Warbler	23	X		
Red-headed Woodpecker	23		X	
Northern Bobwhite	23			X
White-eyed Vireo	22	X		
Yellow-throated Vireo	22	X		
Summer Tanager	22	X		
Eastern Kingbird	22	X		
Grasshopper Sparrow (Winter)	22		X	
Red-shouldered Hawk	21		X	
Gray Catbird	21	X		
Yellow-throated Warbler	21	X		
Carolina Wren	20			X
Worm-eating Warbler	20	X		
Acadian Flycatcher	20	X		
Yellow-breasted Chat	20	X		
Dickcissel	20	X		
Northern Parula Warbler	19	X		
Brown Thrasher	19			X
Pileated Woodpecker	19			X
Common Yellowthroat	19	X		
Black and White Warbler	18	X		
Pine Warbler	18		X	
Blue Grosbeak	18	X		
Blue Jay	18			X
American Redstart	18	X		
Cooper's Hawk	18	X		
Eastern Towhee	18	X		
Northern Cardinal	18		X	X
Tufted Titmouse	18		X	X
Carolina Chickadee	18		X	X
Red-bellied Woodpecker	18		X	X
Wild Turkey	18			X
Common Nighthawk	18	X		
Ruby-throated Hummingbird	17	X		
Indigo Bunting	17	X		
Belted Kingfisher	17		X	X
Eastern Meadowlark	17		X	X
Blue-gray Gnatcatcher	16	X		
Common Grackle	16		X	
Northern Mockingbird	16			X

Table C-17.2 Bird Species Found within the Proposed Red Hills Mine Site in Choctaw County, Mississippi Considered as Vulnerable by the Partners In Flight Program (Jones 1997)

Species	Concern Score*	Neotropical Migrant	Temperate Migrant	Permanent Resident
Barred Owl	16			X
Chipping Sparrow	15	X		
Eastern Bluebird	15		X	
Eastern Phoebe	15		X	
Red-eyed Vireo	15	X		
Downy Woodpecker	15			X
Yellow-shafted Flicker	14		X	
Red-winged Blackbird	14		X	
American Crow	14			X
Mourning Dove	13			X
American Goldfinch	13		X	X
Black Vulture	13		X	X

* Generalized definition of Concern Scores (see Hunter et al. 1993 for further explanation):

(1) 24-29 = Very high concern, more vulnerable and in need of management and/or monitoring.

(2) 19-23 = High concern, average vulnerability or relative vulnerability is unknown but likely in need of monitoring to prevent undetected declines.

(3) 13-18 = Moderate concern, less vulnerable, and possibly in need of monitoring attention to track trends in local populations.

Appendix C-18 Threatened or Endangered Species - U.S. Fish and Wildlife Service Correspondence

United States Department of the Interior

FISH AND WILDLIFE SERVICE
2524 South Frontage Road, Suite B
Vicksburg, Mississippi 39180-5269

November 14, 1996

REPLY REFER TO:
ER 96/712

Mr. Charles P. Nicholson
NEPA Specialist
Tennessee Valley Authority
400 West Summit Hill Dr (WT 8C)
Knoxville, Tennessee 37902-1499

Dear Mr. Nicholson:

This concerns the Tennessee Valley Authority's (TVA) October 16, 1996, Notice of Intent (NOI) to prepare an environmental impact statement (EIS) for a proposed surface lignite coal mine and associated 400 megawatt coal-fired power plant near the City of Ackerman in Choctaw County, Mississippi. Our comments are provided in accordance with the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) and the Endangered Species Act (16 U.S.C. 1531 et seq.).

The NOI adequately discusses the scope and content of the EIS, except there is no discussion of compensation for unavoidable adverse impacts. Over the life of the project, approximately 4,275 acres would be disturbed and reclaimed. The Fish and Wildlife Service (Service) recommends that the reclamation plan for wetlands and other fish and wildlife habitat include compensation that is based on habitat quality. The Service's Habitat Evaluation Procedures (HEP) estimate current habitat conditions, predict future conditions, compare project alternatives, and aids in the development of compensation strategies. HEP is based on the fundamental assumption that the quantity and quality of a habitat can be numerically documented and reasonably predicated for future conditions

There are no federal listed threatened or endangered species present in the project area. We do recommend that the EIS include information on any state sensitive species as well as other species lists including The Nature Conservancy and the Audubon Society.

Thank you for the opportunity to provide early input to the planning process. If you have any questions, please contact me (Tele 601-629-6615).

Sincerely,

Curtis B. James

Curtis B. James
Acting Field Supervisor

cc: USDOI, Natural Resources Mgmt., OEPC, Washington, D.C.
Fish and Wildlife Service, Atlanta, GA

Appendix C-19 Threatened or Endangered Species - Rare Plant Species

Table C-19.1 Rare Plant Species Sought During Field Surveys of Red Hills Power Project Lands in Choctaw County, Mississippi

Common Name	Scientific Name	Federal Status	Habitat
Ohio buckeye	*Aesculus glabra*		*
Earleaf foxglove	*Agalinis auriculata*		*
Purple gerardia	*Agalinis pseudaphylla*		*
Water plantain	*Alisma subcordatum*		Recently rediscovered in adjacent Oktibbeha County, but unlikely to occur in project area.
A pussy-toes	*Antennaria solitaria*		Likely to occur in area, since known from similar adjacent areas. Flowers very early, hence possibly missed by late start of surveys.
Price potato-bean	*Apios priceana*	LT	*
Lake-cress	*Armoracia lacustris*		Some possibility to occur in area, but not seen in intensive surveys of suitable habitat.
A wild ginger	*Asarum canadense*		Suitable habitat intensively surveyed, but not seen. Still some slight possibility.
Green milkweed	*Asclepias hirtella*		Unlikely to occur in area, no suitable habitat.
White heath aster	*Aster ericoides*		*
A milk vetch	*Astragalus canadensis*		*
Wild hyacinth	*Camassia scilloides*		*
Slender sedge	*Carex gracilescens*		*
A sedge	*Carex jamesii*		Slight possibility of occurring in area, but usually in more alkaline soils than present in EIS area.
Small-toothed sedge	*Carex microdonta*		*
A sedge	*Carex picta*		Unlikely to occur in area, since recognizable year-round and suitable habitat thoroughly searched.
A sedge	*Carex prasina*		Unlikely to occur in area, since suitable habitat rare.
Shellbark hickory	*Carya laciniosa*		*
Swamp hickory	*Carya leiodermis*		Present in area. See discussion.
Ozark chinquapin	*Castanea ozarkensis*		Possible in area, though suitable habitat thoroughly searched. May be present as a few shoots, hence easily overlooked. Also can be confused with Castanea pumila.
Scarlet Indian paintbrush	*Castilleja coccinea*		*
A turtlehead	*Chelone glabra*		Present in area. See discussion.
A tickseed	*Coreopsis auriculata*		Slight possibility in area. Long flowering period and diagnostic sterile characters should have made it likely to be discovered if present.
Large yellow lady's slipper	*Cypripedium pubescens*		Some slight possibility for EIS area, though recognizable over a long period and most suitable habitat thoroughly searched.
Dwarf larkspur	*Delphinium tricorne*		*
A shooting star	*Dodecatheon meadia*		*
Pale purple-coneflower	*Echinacea pallida*		Recently found for the first time in Mississippi in southern Choctaw Co. Unlikely to occur within area.
Purple coneflower	*Echinacea purpurea*		*
White dogtooth-violet	*Erythronium albidum*		*
Wahoo	*Euonymus atropurpureus*		*

Table C-19.1 Rare Plant Species Sought During Field Surveys of Red Hills Power Project Lands in Choctaw County, Mississippi			
Common Name	**Scientific Name**	**Federal Status**	**Habitat**
American columbo	*Frasera caroliniensis*		Possible in area, since suitable habitat exists. However, plant is so distinctive through much of the year, that it is unlikely it was missed.
Blue Ash	*Fraxinus quadrangulata*		*
A broom-snakeroot	*Gutierrezia dracunculoides*		*
Crested coral-root	*Hexalectris spicata*		A rich woods species possible in area.
Featherfoil	*Hottonia inflata*		Suitable habitat not present.
Green violet	*Hybanthus concolor*		Not likely. Mostly in rich, calcareous woodlands.
A waterleaf	*Hydrophyllum appendiculatum*		Not likely. A species of rich woods mostly to north of area.
Butternut	*Juglans cinera*		*
Turkscap lily	*Lilium superbum*		Present in area. See discussion.
Ear-flower lobelia	*Lobelia appendiculata*		*
A woodrush	*Luzula acuminata*		Possible, not known from Choctaw Co., but in Webster Co. A rich woods species.
Carolina anglepod	*Matelea carolinensis*		Known from area. See discussion.
Large-flowered anglepod	*Matelea obliqua*		Known from area. See discussion.
A bunchflower	*Melanthium virginicum*		Not likely. Suitable habitat not available.
Yellow parilla	*Menispermum canadense*		Slight possibility, but mostly in calcareous sites.
A monkey-flower	*Mimulus ringens*		Unlikely. Rare species mostly much to north of area.
A muhly	*Muhlenbergia sylvatica*		Possible. Not readily recognizable until October.
Prairie iris	*Nemastylis geminiflora*		*
A sundrops	*Oenothera triloba*		*
Stalked adderstongue	*Ophiogolossum petiolatum*		Known from area. See discussion.
Anise-root	*Osmorhiza longistylis*		Not likely to occur in area, though habitat in a few instances appears to be suitable. Easily recognizable through much of the year, so unlikely to be overlooked.
Allegheny-spurge	*Pachysandra procumbens*		Similarly to previous species, not likely to occur in area. Habitat perhaps is sometimes suitable, but again recognizable throughout the year.
Ginseng	*Panax quinquefolius*		Habitat in several instances appears to be suitable and would be expected to occur. However, not seen in rather intensive surveys of such areas. Easily recognizable this time of year by the red fruit. Perhaps was overcollected for the herbal market at sometime in the past and exterminated.
A beard-tongue	*Penstemon tenuiflorus*		*
A perideridia	*Perideridia americana*		*
Odorless mock-orange	*Philadelphus inodorus*		Within EIS area, see discussion.
Crested fringed orchid	*Platanthera cristata*		Possible in area. Some boggy sites might have this species, but most were searched with no evidence of its occurrence.
Ragged fringed orchid	*Platanthera lacera*		Present in area. See discussion.
Purple fringeless orchid	*Platanthera peramoena*		Quite possible in area, but easily seen and unlikely to be overlooked.
Prairie parsley	*Polytaenia nuttallii*		*

Table C-19.1 Rare Plant Species Sought During Field Surveys of Red Hills Power Project Lands in Choctaw County, Mississippi			
Common Name	**Scientific Name**	**Federal Status**	**Habitat**
A rattlesnake-root	*Prenanthes aspera*		*
Bur Oak	*Quercus macrocarpa*		*
A buckthorn	*Rhamnus lanceolata*		*
Bay starvine	*Schisandra glabra*		Possible. Found at two localities in adjacent counties in similar, rich wood habitats.
Rock-moss	*Sedum pulchellum*		*
Great plain ladies'-tresses	*Spiranthes magnicamporum*		*
Oval ladies'-tresses	*Spiranthes ovalis*		Highly likely in area. Flowering late September- October.
Bladdernut	*Staphylea trifolia*		Occurs in area. See discussion.
Yellow pimpernell	*Taenidia integerrima*		*
A meadowrue	*Thalictrum debile*		*
Foamflower	*Tiarella cordifolia*		Unlikely in area, though known from one location in Winston Co. Mostly occurs to north of area.
A horse-gentian	*Triosteum angustifolium*		Possible, but unlikely. Occurs in rich, calcareous woodlands.
Three-birds-orchid	*Triphora trianthophora*		Very likely in area, but small size, late and sporadic appearance tend to make it difficult to find.
September elm	*Ulmus serotina*		
Mapleleaf viburnum	*Viburnum acerifolium*		Unlikely, known only in state from one site in Webster County.

*Species only known from highly calcareous sites of Pontotoc Ridge or Northeast Prairie. Very unlikely to occur in EIS area.

Appendix C-20 Land Use - Agricultural Production

Table C-20.1 Agricultural Production in Choctaw County, Mississippi, 1982-1992 [a)]

Statistic	Units	1992	1987	1982
Total land area	(acres)	268,242	268,633	268,633
Proportion in farms	(percentage)	16	18	28
Farms	(number)	195	228	332
Total land in farms	(acres)	42,712	47,224	76,105
Average size of farms	(acres)	219	207	229
Total cropland	(farms)	168	200	304
Total cropland	(acres)	19,141	21,152	39,700
Harvested cropland	(farms)	147	138	256
Harvested cropland	(acres)	9,408	9,169	27,016
Market value of Ag products sold	($1,000)	5,327	3,650	5,372
	(avg/farm, $)	27,319	16,009	16,182
Market value of crops	($1,000)	831	612	2,828
Market value of livestock, poultry, and products	($1,000)	4,496	3,038	2,544
Net cash return Ag sales	($1,000)	846	244	(NA)
Net cash return Ag sales	(avg/farm, $)	4,338	1,069	(NA)
Cattle and calves inventory	(farms)	132	165	260
Cattle and calves inventory	(number)	6,849	7,535	10,435
Corn for grain or seed	(farms)	23	20	71
Corn for grain or seed	(acres)	820	272	709
Corn for grain or seed	(bushels)	84,227	16,253	31,575
Cotton	(farms)	5	8	12
Cotton	(acres)	1,315	(NA)	2,031
Cotton	(bales)	1,527	622	2,532
Soybeans for beans	(farms)	7	10	51
Soybeans for beans	(acres)	685	2,746	16,107
Soybeans for beans	(bushels)	22,100	32,009	264,697
Hay	(farms)	121	115	190
Hay	(acres)	4,276	2,925	4,572
Hay	(dry tons)	6,941	5,244	7,623
Pastureland	(farms)	157	197	270
Pastureland	(acres)	18,997	20,635	27,685
Woodland, in farms	(farms)	155	173	256
Woodland, in farms	(acres)	19,065	18,799	28,604
Sale of forest products	(farms)	31	18	(NA)
and Christmas trees	($1,000)	220	8	(NA)

[a)] Source: US Department of Commerce, Bureau of the Census (1993a, 1989, 1984).

Appendix C-21 Cultural and Historical Resources - Mississippi Department of Archives and History Correspondence

Mississippi Department of Archives and History

Historic Preservation Division • Post Office Box 571 • Jackson, Mississippi 39205-0571
Telephone 601-359-6940 • Fax 601-359-6955

Established 1902

January 7, 1998

Mr. J. Bennett Graham
Senior Archaeologist
Tennessee Valley Authority
Box 920
Norris, Tennessee 37828-0920

Dear Mr. Graham:

RE: Proposed Red Hills Power Project/Mississippi Lignite Mining Company & Choctaw Generation, Choctaw County (97-175)

We have reviewed the December 17, 1997, letter, with attached final cultural resources survey report and supplementary description of the field methodology employed, of Dr. Robert M. Thorne, Director of the Center for Archaeological Research, The University of Mississippi, regarding the above referenced undertaking.

The aforementioned material addressed all of the outstanding concerns outlined in my December 9, 1997, letter to you. There remains a very remote possibility that unrecorded cultural resources may be encountered during construction. Should this occur, we would appreciate your contacting us immediately so that we may take appropriate steps under 36CFR800, part 11, regarding our response within forty-eight hours. If further clarification is needed, please contact this office at 359-6940

Sincerely,

Elbert R. Hilliard
State Historic Preservation Officer

Roger G. Walker

By: Roger G. Walker
Review and Compliance Officer

cc: Clearinghouse for Federal Programs

Appendix C-22 Cultural and Historical Resources - Mississippi Department of Archives and History Correspondence

Mississippi Department of Archives and History

Historic Preservation Division • Post Office Box 571 • Jackson, Mississippi 39205-0571
Telephone 601-359-6940 • Fax 601-359-6955

Established 1902

July 22, 1997

Mr. Charles R. Tichy
Historic Architect
Tennessee Valley Authority
Box 920
Norris, Tennessee 37828-0920

Dear Mr. Tichy:

RE: Proposed lignite mining project in Choctaw County

We have reviewed your July 10, 1997, letter and the attached Historic Resources Inventory forms and photographs regarding structures over fifty years of age in connection with the above referenced undertaking. We concur that none of the twelve properties in the direct impact area (group one) and none of the eleven properties in the indirect area (group two) are eligible for listing in the National Register of Historic Places. We also concur that Sites M and N in the community of Chester may be eligible but there is insufficient information to confirm their eligibilities; in any event, they will not be affected. We, therefore, have no further reservations with this project.

There remains a very remote possibility that unrecorded cultural resources may be encountered during construction. Should this occur, we would appreciate your contacting us immediately so that we may take appropriate steps under 36CFR800, part 11, regarding our response within forty-eight hours. If further clarification is needed, please contact this office at 359-6940.

Sincerely,

Elbert R. Hilliard
State Historic Preservation Officer

Roger G. Walker

By: Roger G. Walker
Review and Compliance Officer

cc: Clearinghouse for Federal Programs

Appendix C-23 Public Health - Radiation

Cosmic Radiation

Exposure to cosmic radiation on the surface of the earth results from charged particles originating in outer space that strike the Earth's upper atmosphere. Extremely energetic particles impact the upper atmosphere and shower the surface of the Earth with ionizing radiation. The average cosmic-ray annual dose equivalent is about 26 mrem (NCRP 1987a, b, and c). In the lower atmosphere, this dose rate increases with altitude, doubling with each 2,000 ft increase in altitude. The dose rate also changes in a complex way with shielding from homes and other buildings. Except for a few population centers in the western United States, the annual dose equivalent rate of 26 mrem/year is typical of most of the United States, including all of Mississippi.

Terrestrial Radiation

Terrestrial radiation is ionizing radiation that originates from naturally occurring radioactive materials in rocks and soil. These radioactive materials are primordial radionuclides that have existed since the origin of the Earth. That is, they have such a long half-life that they have not yet decayed away. Terrestrial radiation primarily results from two chains of radionuclides and the nonchain radionuclide K-40 potassium isotope. The uranium chain is headed by U-238 with a half-life of 4.5 billion years. The uranium chain contains 14 different radioactive isotopes that emit radiations that contribute to human exposure. Similarly, the thorium chain is headed by Th-232 with a half-life of 14 billion years. The thorium chain contains 11 different radioactive isotopes. The nonchain radionuclide K-40 has a half-life of 1.3 billion years.

The numerous radioisotopes in the two chains emit alpha, beta, and gamma radiations and K-40 emits beta and gamma radiations. While alpha, beta, and gamma radiations are important to internal dosimetry, only the penetrating gamma radiations are of interest in this discussion of terrestrial radiation. The dose that people receive from terrestrial radiation depends directly on the concentrations of radioactive materials in the upper foot of soil. The exposure that an individual receives also varies with the type of housing used and other factors. All of Mississippi lies in the Atlantic and Gulf Coastal Plain that has an average dose equivalent rate that varies from 15 to 35 mrem/year, the lowest exposure rate in the country (NCRP 1987a). For the purposes of this analysis, an average value of 25 mrem/year is assumed to represent the annual dose equivalent rate for the RHPP area.

Internal Radiation

The human body is made up of numerous different types of atoms, some of which are radioactive. These naturally radioactive materials inside our bodies give rise to an internal radiation dose. While internal radiation exposure results from numerous different types of radionuclides, most of this dose is from the K-40 potassium isotope. Potassium is a necessary metabolic element and its concentration in the human body is rigidly controlled. All potassium found in nature consists of three isotopes, two are stable, but

K-40 is radioactive. The average internal radiation dose equivalent is 39 mrem/year. This dose does not vary significantly with geographical location, personal factors, or other variables.

Radiation Exposure From Radon Progeny

Radon is an inert, radioactive gas that is a member of the U-238 chain. Since U-238 and its daughter isotopes or progeny are present in rocks and soil, radon is continuously produced in soil. Because this radioactive material is an inert gas, it does not chemically bond to soil or rocks. Thus, while its migration in soil is affected by water and other materials, radon is generally free to move and to exit soil and enter the atmosphere and homes and other buildings. Since radon is chemically inert, most radon that is inhaled is also exhaled. Radon itself is not, therefore, particularly hazardous. However, airborne radon decays into chemically active radionuclides that attach to dust particles in the air. Thus, airborne dust particles become radioactive from attached radon daughters and these dust particles are inhaled by people. Thus, the lung receives a radiation dose from radon daughters. The dose from radon daughters varies widely within small geographic regions in complex ways that are poorly understood. The average annual dose equivalent from radon daughters is approximately 200 mrem.

Appendix D-1 Air Resources - Hazardous Air Pollutants

Table D-1.1 Hazardous Air Pollutants Emissions[a]		
	Emissions	
Pollutant	Tons/Year	Grams/sec (g/s)
Particulate-Matter Trace Elements:		
Antimony (Sb)	0.008	0.00024
Arsenic (As)	0.072	0.00208
Beryllium (Be)	0.003	0.00009
Cadmium (Cd)	0.053	0.00153
Chromium (Cr)	0.103	0.00297
Cobalt (Co)	0.023	0.00066
Lead (Pb)	0.076	0.00218
Manganese (Mn)	0.153	0.00441
Nickel (Ni)	0.126	0.00363
Gaseous Trace Elements:		
Chlorine (HCl)	120	3.44
Fluorine (HF)	17.7	0.510
Mercury (Hg)	0.294	0.00847
Selenium (Se)	1.74	0.0501
Organic Pollutants:		
1,1-Dichloroethane	0.019	0.00056
1,2-Dibromoethane	0.056	0.00162
1,2,4-Trichlorobenzene	0.033	0.00094
1,3-Dichloropropene	0.016	0.00045
1,4-Dichlorobenzene	0.024	0.00069
2-Butanone	0.067	0.00193
2,3,7,8-TCDD (Dioxin-equiv.)	4.4E-08	1.3E-09
2,4-Dinitrotoluene	0.004	0.00012
3-Chloropropylene	0.197	0.00568
3-Methylphenol	0.015	0.00044
4-Methyl-2-pentanone	0.050	0.00143
4-Methylphenol	0.028	0.00081
Acetaldehyde	0.298	0.00858
Acetophenone	0.026	0.00075
Acrolein	0.041	0.00119
Benzene	0.359	0.0103
Benzyl chloride	0.006	0.00017
Biphenyl	0.003	0.00010
bis(2-Ethylhexyl)phthalate	0.078	0.00225
Bromomethane	0.019	0.00056
Carbon disulfide	0.024	0.00069
Chlorobenzene	0.003	0.00010
Chloroethane	0.011	0.00033
Chloroform	0.028	0.00081
Chloromethane	0.024	0.00069
Dibenzofuran	0.013	0.00036
Dibutylphthalate	0.002	0.00007

Table D-1.1 Hazardous Air Pollutants Emissions[a]		
	Emissions	
Pollutant	Tons/Year	Grams/sec (g/s)
Dimethylphthalate	0.002	0.00006
Ethyl benzene	0.017	0.00050
Formaldehyde	0.565	0.0162
n-Hexane	0.011	0.00031
Iodomethane	0.043	0.00125
Isophorone	0.026	0.00075
Methyl chloroform	0.013	0.00038
Methyl methacrylate	0.024	0.00069
Methylene chloride	0.078	0.00225
Naphthalene	0.191	0.00549
Phenol	0.098	0.00282
Propionaldehyde	0.041	0.00119
Styrene	0.015	0.00044
Tetrachloroethylene	0.009	0.00026
Toluene	0.037	0.00106
Vinyl acetate	0.007	0.00019
Vinyl chloride	0.016	0.00046
Xylenes	0.027	0.00079
Polycyclic organic matter (POM)	0.062	0.00177

[a] Emission Factors Handbook, Guidelines for Estimating Trace Substance Emissions from Fossil-Fuel Steam Electric Plants, EPRI TR-105611, November 1995.

Appendix D-2 Air Resources - Hazardous Air Pollutants

Table D-2.1 Estimated Maximum One-hour Ambient Concentrations of Hazardous Air Pollutants

	Threshold Levels		
	Occupational TLV-TWA	Community TLV-TWA/40	Maximum One-hour Concentration
Pollutant	μg/m³	μg/m³	μg/m³
Particulate Matter Trace Elements:			
Antimony (Sb)	500	12.50	0.00030
Arsenic (As)	10	0.25	0.00259
Beryllium (Be)	2	0.05	0.00011
Cadmium (Cd)	10	0.25	0.00190
Chromium (Cr)	500	12.50	0.00369
Cobalt (Co)	20	0.50	0.00082
Lead (Pb)	50	1.25	0.00271
Manganese (Mn)	200	5.00	0.00548
Nickel (Ni)	1,000	25.00	0.00451
Gaseous Trace Elements:			
Chlorine (HCl)	750[a]	18.75	4.27444
Fluorine (HF)	3,000[b]	75	0.63448
Mercury (Hg)	25	0.63	0.01053
Selenium (Se)	200	5.00	0.06230
Organic Pollutants:			
1,1-Dichloroethane	405,000	10125	0.00069
1,2-Dibromoethane	150,000[b]	3750	0.00202
1,2,4-Trichlorobenzene	3,700[a]	92.5	0.00116
1,3-Dichloropropene	347,000	8675	0.00056
1,4-Dichlorobenzene	60,000	1500	0.00085
2-Butanone	590,000	14750	0.00240
2,3,7,8-TCDD (Dioxin-equiv.)	1[c]	0.025	1.6×10^{-9}
2,4-Dinitrotoluene	200	5	0.00016
3-Chloropropylene	3,000	75	0.00706
3-Methylphenol	22,000	550	0.00055
4-Methyl-2-pentanone	205,000	5125	0.00178
4-Methylphenol	22,000	550	0.00101
Acetaldehyde	180	4.5	0.01067
Acetophenone	49,000	1225	0.00093
Acrolein	230	5.75	0.00147
Benzene	32,000	800	0.01284
Benzyl chloride	5,200	130	0.00022
Biphenyl	1,300	32.5	0.00012
bis(2-Ethylhexyl)phthalate	NA[d]		0.00279
Bromomethane	3,900	97.5	0.00069
Carbon disulfide	31,000	775	0.00085
Chlorobenzene	46,000	1150	0.00012
Chloroethane	264,000	6600	0.00041
Chloroform	49,000	1225	0.00101
Chloromethane	103,000	2575	0.00085
Dibenzofuran	1[c]	0.025	0.00045
Dibutylphthalate	5,000	125	0.00009
Dimethylphthalate	5,000	125	0.00007

Table D-2.1 Estimated Maximum One-hour Ambient Concentrations of Hazardous Air Pollutants			
	Threshold Levels		Maximum One-hour Concentration
	Occupational TLV-TWA	Community TLV-TWA/40	
Pollutant	μg/m^3	μg/m^3	μg/m^3
Ethyl benzene	434,000	10850	0.00062
Formaldehyde	900[b]	22.5	0.02019
n-Hexane	176,000	4400	0.00038
Iodomethane	12,000	300	0.00155
Isophorone	140,000[b]	3500	0.00093
Methyl chloroform	1,910,000	47750	0.00047
Methyl methacrylate	410,000	10250	0.00085
Methylene chloride	174,000	4350	0.00279
Naphthalene	52,000	1300	0.00683
Phenol	19,000	475	0.00351
Propionaldehyde	NA[d]		0.00147
Styrene	213,000	5325	0.00054
Tetrachloroethylene	170,000	4250	0.00033
Toluene	188,000	4700	0.00132
Vinyl acetate	35,000	875	0.00024
Vinyl chloride	13,000	325	0.00057
Xylenes	434,000	10850	0.00098
Polycyclic organic matter (POM)	150[b]	3.75	0.00220

Source: ACGIH unless otherwise noted.
[a] 1/10 ACGIH ceiling
[b] OSHA
[c] NIOSH CIB45
[d] Not Available
[e] Community safety threshold levels, estimated from Occupational threshold limit values-time weighted averages (TLV-TWA)

Appendix D-3 Air Resources - Ozone

This potential increase of ozone was quantified by performing photochemical modeling for the period July 7-18, 1995. Data used in the analysis were created as part of the modeling efforts of the Ozone Transport Assessment Group (OTAG), the period chosen was an episode during which conditions were favorable for ozone formation. The emissions inventory used in the modeling was based on growth and emissions controls projected for the year 2007. The emissions inventory was modified to incorporate the generation facility emissions, the photochemical model was run with this revised emissions inventory, and the results were compared with those from a run without the generation facility.

There are insufficient data and protocols to accurately assess the future attainment status of RHPP area. This requires three consecutive years of monitoring data and, in the case of the particulate matter standard, new sampling instrumentation. Although the EPA schedule for attainment status designation is several years off, the potential exist for impact of the revised ozone and particulate matter standards on RHPP and the surrounding area. An assessment of historical ozone and particulate matter monitoring data across the Tennessee Valley region indicates a potential for nonattainment for both these standards

across the Southeast.

The maximum predicted O_3 increase for the one-hour and eight-hour average was 23 and 15 ppb, respectively. The estimated increase in O_3 concentration typically fell in the 2 to 6 ppb range and occurred primarily within about 200 km of the RHGF site. These increases should not be used to draw conclusions regarding future nonattainment status of an area since nonattainment (for the eight-hour standard) will be based on measurements over a three year period. Meteorological episodes conducive to O_3 production occur several times during most summers; it is during these episodes that O_3 increases similar to those presented would be expected to occur. Emissions of NOx into the atmosphere can lead to the formation of O_3 through a complex series of photochemical reactions. Ozone concentrations in the area surrounding the generation facility are relatively low, with summertime maximum one- and eight-hour concentrations falling between 80 to 90 and 70 to 80 ppb, respectively. Measured NOx emissions from the generation facility will result in formation of additional O_3 which will slightly increase these concentrations.

Figure D-3.1 presents a composite of the maximum increase in one-hour average O_3 predicted to occur on any day during the 12-day episode. Figure D-3.2 presents comparable information for the daily maximum eight-hour average O_3 increase. These figures present the maximum increase occurring on each day of the episode (hence the "episode composite" label). Increases on any single day would be much more limited in spatial distribution than that depicted in an episode composite.

Figure D-3.1 Increase in estimated maximum daily one-hour O_3 concentration (ppb) during the period July 7-18, 1995, due to NOx emissions from the RHGF.

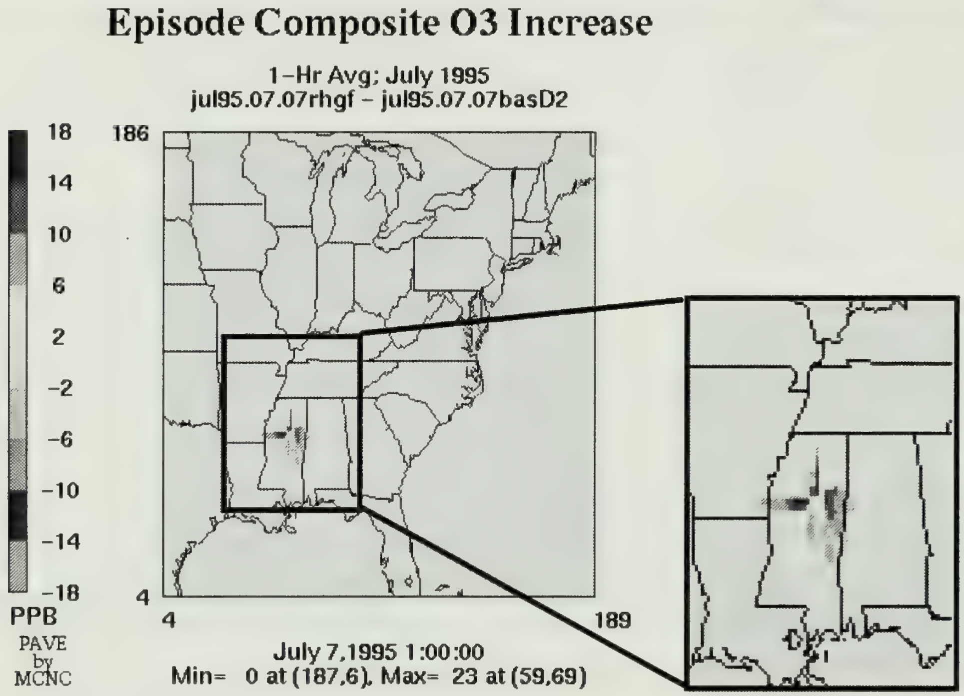
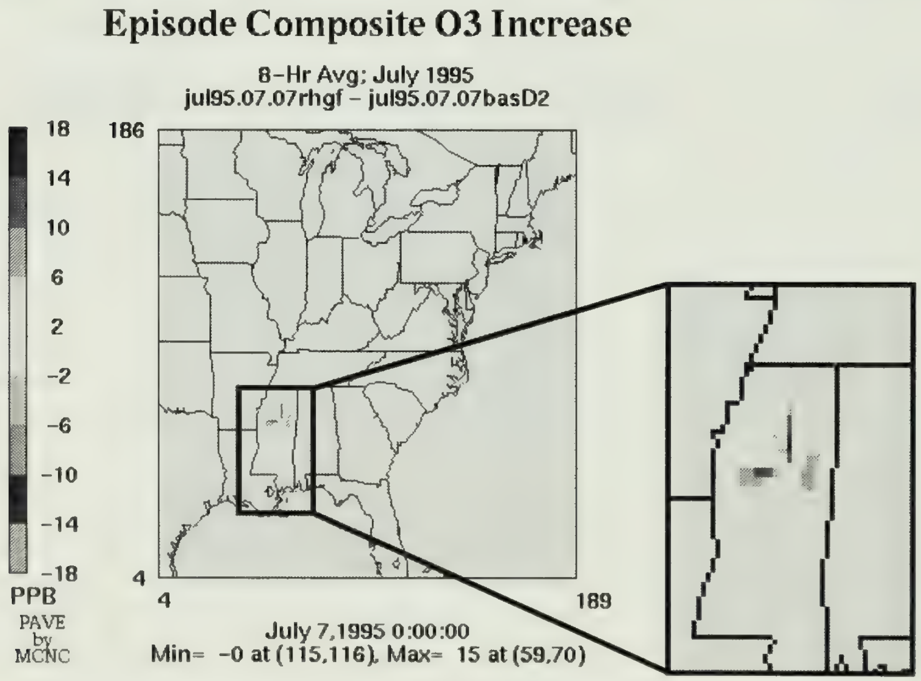


Figure D-3.2 Increase in estimated maximum daily eight-hour O_3 concentration (ppb) during the period July 7-18, 1995, due to NOx emissions from the RHGF.



Appendix D-4 Groundwater Resources - Description of Groundwater Flow Model and Observations Regarding Simulations

The MODFLOW groundwater flow code developed by the U.S. Geological Survey (McDonald and Harbaugh 1988) was used to quantitatively evaluate the potential effects of generation facility groundwater withdrawals for cooling water supply on existing groundwater users. The model was also used in estimating potential movement of saltwater-freshwater boundaries as a result of generation facility groundwater use. MODFLOW is unquestionably the most widely used and best documented code for saturated groundwater flow applications, and therefore represents a credible numerical code for the present assessment.

For purposes of the modeling analysis, the hydrogeology of the site region was conceptualized as a three-dimensional layered system consisting of six aquifers and five intervening aquitards. These units extend stratigraphically from the Lower Cretaceous Aquifer up to and including the Lower Wilcox Aquifer. Table D-4.1 summarizes the hydraulic properties and dimensions associated with each model layer and provides the basis for parameter selection. The thickness and hydraulic characteristics of each model layer were assumed to be uniform. The model domain covers about 40,000 square miles, encompassing most of northern Mississippi and smaller parts of Alabama, Arkansas, and Tennessee (Figure 4.5-1). The model grid consisted of 66 rows, 76 columns, and 14 layers. (Note that it was necessary to represent some of the thicker hydrostratigraphic units as two layers in the model.) Horizontal grid intervals ranged from 3,125 ft in the project site vicinity to 25,000 ft in outlying regions of the model. Hydraulic conductivity (K) was assumed to be isotropic in the horizontal dimension, whereas a uniform ratio of horizontal to vertical (K_h/K_v) of 10 was assumed for all layers. A conservatively low storativity of 10^{-4} was applied to the confined portions of all aquifers and aquitards. Unconfined areas corresponding to the aquifer outcrops were assigned storativity values of 0.2. Except for the Lower Cretaceous Aquifer, the layer thicknesses used in the model were derived from geophysical logs for Test Hole 1. The rationale for this approach is that local hydrostratigraphic conditions will largely determine the vertical propagation of drawdown effects between aquifers in the region of maximum drawdown. No-flow boundary conditions were assigned to the perimeter cells of the model domain. Where applicable, the spatial limits of aquifers were represented in the model layers by designating cells outside the depositional limits of the aquifer as inactive cells. Information regarding aquifer depositional limits and outcrop areas used in the model were obtained from Strom and Mallory (1995) and Gandl (1982). Confining layers were set at the top of the Lower Wilcox Aquifer layer and at the base of the lower layer of the Lower Cretaceous Aquifer. For conservatism, no surface recharge by precipitation was assumed in aquifer outcrops or other areas of the model. The global mass balance error for the 30-year simulation was less than 0.3%.

Although the focus of this appendix is not on the modeling results, we offer the following discussion to aid in the interpretation and understanding of the simulation results presented in Section 4.5. First, the interior boundary conditions of the model corresponding to depositional limits and aquifer outcrops controlled to a large extent the final predicted potentiometric distribution in the model. Examination of

Figure 4.5-1 shows that predicted drawdowns in the Lower Wilcox Aquifers generally increase toward the southwest with maximum drawdown in the southwestern corner of the model. One would normally expect the drawdown distribution in the overlying aquifers to be a subdued reflection of that in the pumped aquifer (Massive Sand) with the maximum drawdown in the vicinity of the well field. However, the relatively high storativity in the unconfined outcrop areas of the overlying aquifers tends to attenuate the drawdown effects propagated upward from the Massive Sand. The result is the observed increase in drawdown with distance away from the outcrop areas in these layers. Second, the close proximity of the Massive Sand depositional limit to the well field resulted in propagation of pressure declines throughout the southern half of the model. Predicted drawdown within this layer is likely overestimated because the artificial no-flow boundaries imposed at the lateral boundaries of the model interfere with the natural propagation of pressure effects to the south and east into regions beyond the model boundaries. In addition, the no-flow boundaries associated with the depositional limits of the Massive Sand (and other aquifers in the model) also produce overestimates of drawdown. Aquifer depositional limits are geologic formation limits and not hydraulic barriers. The contiguous geologic formations which lie beyond the aquifer depositional limits have finite hydraulic conductivities which would allow propagation of drawdown effects beyond the physical limits imposed by the model, and thereby lessen the overall magnitude of drawdown predicted in the aquifer. Thus, assumptions regarding model boundary conditions tend to overestimate drawdown response, and consequently add another element of conservatism to the analysis.

Table D-4.1 Summary of Groundwater Flow Model Parameters

Hydrostratigraphic Unit	Model Layer No.	Top Depth (ft)	Bottom Depth (ft)	Layer Thickness (ft)	K_h (ft/d)	K_h/K_v	T (ft^2/d)	Basis
L. Wilcox	1	300	450	150	14	10	2,040	Mean T estimated from reported aquifer tests (w/o Ackerman test result) in Choctaw Co. [Slack and Darden 1991] and Test Hole 1 rig-supply well test
aquitard	2	450	1065	615	1E-04	10	--	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory [1995]
aquitard	3	1065	1880	815	1E-04	10	--	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory [1995]
Eutaw-McShan	4	1880	2300	420	2.4	10	1,000	Median T for aquifer tests in Mississippi reported by Slack and Darden [1991]
aquitard	5	2300	2350	50	1E-04	10	--	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory [1995]
Gordo	6	2350	2745	395	24	10	9,400	Oakley's (USGS) estimate from Test Hole 1 geophysical log [R.W. Harden & Assoc., Inc. 1997b]
aquitard	7	2745	2865	120	1E-04	10	--	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory [1995]
Coker	8	2865	2965	100	100	10	10,000	Oakley's (USGS) estimate from Test Hole 1 geophysical log [R.W. Harden & Assoc., Inc. 1997b]
aquitard	9	2965	3000	35	1E-04	10	--	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory [1995]
Massive Sand	10	3000	3100	100	136	10	13,560	Oakley's (USGS) estimate from Test Hole 1 geophysical log [R.W. Harden & Assoc., Inc. 1997b]
Massive Sand	11	3100	3295	195	136	10	26,440	Oakley's (USGS) estimate from Test Hole 1 geophysical log [R.W. Harden & Assoc., Inc. 1997b]
aquitard	12	3295	3465	170	1E-04	10	--	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory [1995]
L. Cretaceous	13	3465	3715	250	239	10	59,829	T = 140,000 ft^2/d for L. Cretaceous estimated from Fig. 24 of Strom & Mallory [1995]; proportioned between model layers based on thickness.
L. Cretaceous	14	3715	4050	335	239	10	80,171	T = 140,000 ft^2/d for L. Cretaceous estimated from Fig. 24 of Strom & Mallory [1995]; proportioned between model layers based on thickness.

Storativity set to 1.0E-04 in confined portions of all aquifers and to 0.2 in outcrop areas.

Appendix D-5 Noise - Measures of Noise Impact

Hearing Loss

Impacts of environmental noise exposure on people come from potential hearing loss and annoyance as described in 3.19.1. The magnitude of hearing loss impact on an exposed population is estimated by a method presented by Harris (1991) when noise levels are high enough. This method uses a hearing protection weighting factor (H_i) that is based on the equal acoustic energy needed to cause different levels of industrial hearing loss. The total acoustic energy in the eight-hour industrial noise exposure is spread over 24 hours for the general public exposure. The following table presents these hearing protection weighting factors as a function of L_{DN}.

Table D-5.1 Hearing Protection Weighting Factors (H_i)

L_{DN} Range (dBA)	H_i
<75	0
75 - 76	0.01
76 - 77	0.05
77 - 78	0.2
78 - 79	0.3
79 - 80	0.5
80 - 81	0.8
81 - 82	1.1
82 - 83	1.4
83 - 84	1.8
84 - 85	2.3

The estimated potential average loss (PHL) in decibels (dB) of the noise exposed population is calculated by the following equation.

$$PHL = \Sigma H_i P_i / \Sigma P_i \qquad P_i \text{ - population at ith } L_{DN}$$

This method of estimating hearing loss corresponds well to EPA's discussion in its 1974 levels documents (Office of Noise Abatement and Control 1974). There EPA asserts that lifetime hearing loss from noise exposure begins at 70 dBA L_{eq} (24). If an L_{DN} was calculated from this 70 dBA L_{eq} (24) it would be 76.4 dBA, which is about the same starting point as the Harris (1991) method above. The 70 dBA is the first criterion for hearing loss evaluation.

Annoyance

Annoyance from intruding environmental noise comes from communication interference and general disturbance. The magnitude of communication interference must be examined for both indoor and outdoor communications. EPA provides direction on estimating the magnitude of speech interference for both indoor and outdoor environments (Office of Noise Abatement and Control 1974). The following table provides data on the estimation of interference with sentence intelligibility.

Table D-5.2 Percent Interference with Sentence Intelligibility at 2 Meters Distance[1]

Outdoor L_{DN} (dBA)	% Interference Outdoors	% Interference Indoors[2]
<50	0	0
50	0.5	0
55	1	0
60	5	0
65	8	0.5
70	53	1
75	100	5
80	100	8

[1]Data taken from Figure D-4, Office of Noise Abatement and Control 1974.
[2]Assumes 15 dB attenuation from outdoors to indoors.

A method for estimating the general disturbance from intruding environmental noise is recommended by Harris (1991). An analysis of 18 surveys of people's responses to intruding environmental noise resulted in a relationship between L_{DN} and the percentage of people who reported being highly annoyed. The following table gives some data points of the relationship between L_{DN} and reported annoyance.

Table D-5.3 Annoyance Reporting

L_{DN} (dBA)	% Highly Annoyed
40	2
45	3
50	6
55	9
60	13
65	20
70	28
75	37
80	47
85	59

This method predicts the relative, self-reported impact of general disturbance on exposed population at varying levels of environmental noise, but it does not predict the responses from these populations.

In its document (Office of Noise Abatement and Control 1974) EPA presented information on community response. Combined data from community case studies were used to summarize five levels of response based on intruding L_{DN}, Table D-5.4.

Table D-5.4 Community Response to Intruding Environmental Noise	
Intruding L_{DN} (dBA)	Community Response
50 - 62	No overt reaction although noise is generally noticeable
52 - 65	Sporadic complaints
60 - 75	Widespread complaints, individual threads of legal action
70 - 80	Widespread threats of legal action, strong appeals to local officials to stop noise
75 - 85	Vigorous action

The data for the intruding L_{DN} column on Table D-5.4 overlap because they are summary information from several case studies, and it indicates that community response is not wholly predictable based only on intruding noise levels. Annoyance and community response can also depend on some qualitative and subjective variables. People's attitude toward the source of the intruding noise is very important. People who believe the source of the noise is a positive, important asset to themselves and the community will tolerate a relatively high level of intruding noise. Whereas people who believe the noise source is not a personal or community asset will tolerate very little, if any, intruding noise. Other variables of intruding noise that affect community response are characteristics such as whether it is impulsive or has noise surges, if it is narrow band or monotone, and if it is high pitch or frequency.

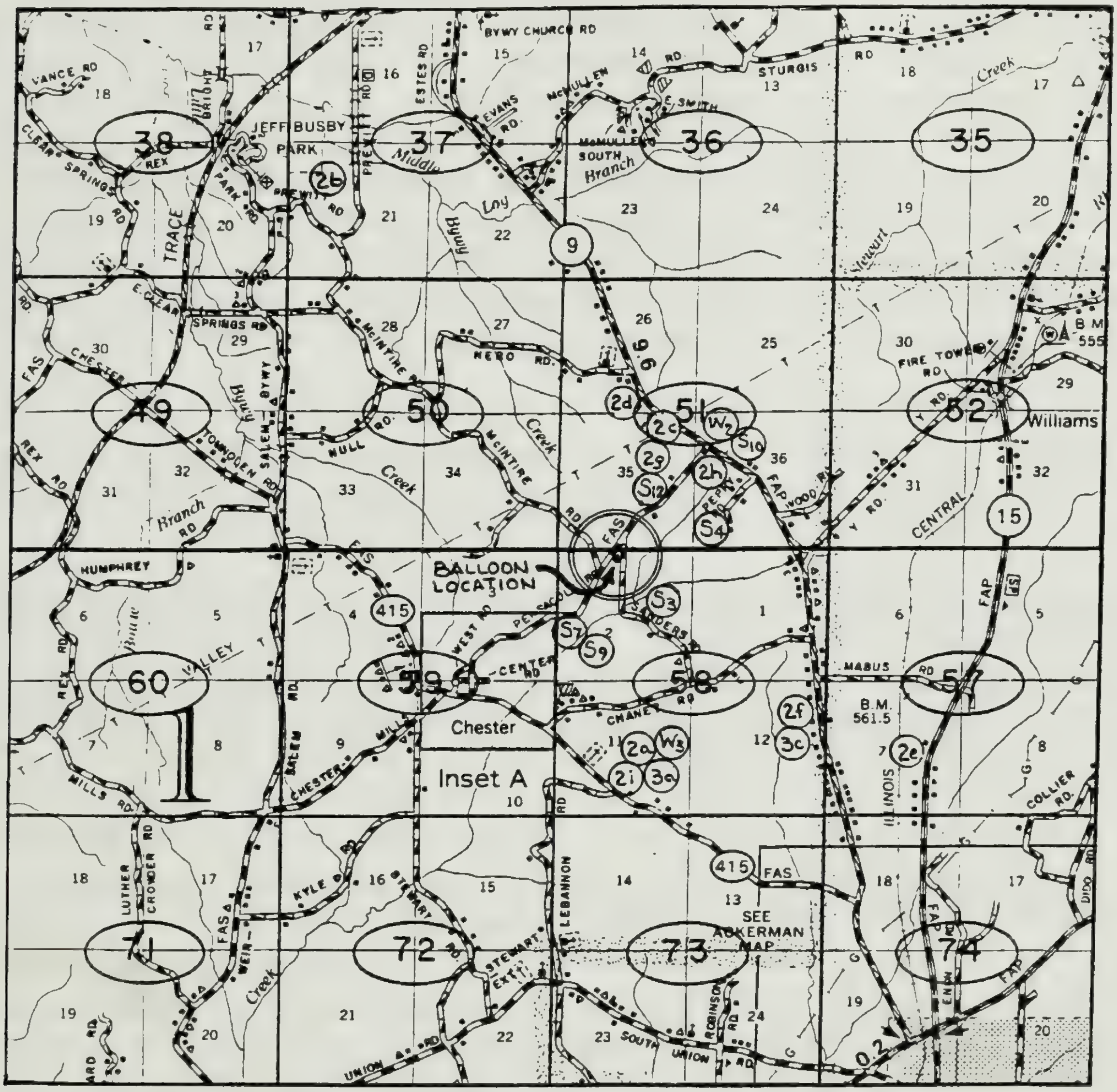
As a summary to its discussion on the potential levels of impact from environmental noise, EPA published a table (Office of Noise Abatement and Control 1974) that gives yearly L_{DN} values that it believes will protect the public health and welfare with an adequate margin of safety. EPA states that these values must not be viewed as standards, criteria, regulations, or goals, but rather as levels below which there is no reason to suspect that the general public will be at risk from any identified effects of environmental noise. These values have been used extensively in evaluating environmental noise impacts. The EPA table follows.

Table D-5.5 Yearly L_{DN} Values that Protect Public Health and Welfare with a Margin of Safety		
Effect	Level	Area
Hearing Loss	$L_{eq}(24) \leq 70$ dBA ($L_{DN} \leq 76.4$ dBA)*	All areas (at the ear)
Interference and annoyance with outdoor activities	$L_{DN} \leq 55$ dBA	Outdoors in residential areas, farms, and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq}(24) \leq 55$ dBA ($L_{DN} \leq 61.4$ dBA)*	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Interference and annoyance with indoor activities	$L_{DN} \leq 45$ dBA	Indoor residential areas
	$L_{eq}(24) \leq 45$ dBA ($L_{DN} \leq 51.4$ dBA)*	Other indoor areas such as schools, etc.

*Calculated L_{DN} values from the $L_{eq}(24)$.

Appendix D-6 Visual Resources - Stack Visibility Demonstration

Choctaw County map with balloon height and sighting locations for plant stack visibility demonstration.



KEY MAP
Choctaw County, MS

NORTH

RED HILLS POWER PROJECT
BALLOON SIGHTING LOCATIONS 7/15/97
(Referenced to Visual Assessment Photo Index)

8:00 - 10:00 am, 350 ft. balloon ht. Sites 2a, 2b, 2c, 2e, 2f

10.00 - 11:00 am, 300 ft. balloon ht. Sites 2g, 2h, 2I; S3, S4, S7, S9, S10, S12, W2, W3

11:00 - 12:00 am, 250 ft. balloon ht. Sites 3a, 3c

(Observations by others: S = T. Schneider, W = M. Walker)

Appendix D-7 Visual Resources - Analysis

D-7.1 Viewpoint Analysis and Photo Simulation Process

Photographs were taken from the east facing overlook on May 14, 1997. A 35-mm camera with a 50-mm lens was used, which approximates a person's viewable area. The weather conditions on the day the photographs were taken were typical for the time of year. The sky was hazy and poor definition obscured objects in the distance. However, these conditions were satisfactory to see the distant horizon, which includes the entire project area. The generation facility area was within viewable distance of the east facing overlook and the NPS water tank. If vegetation did not block the view, the generation facility could be seen under normal weather conditions. Visibility Analysis and photo realistic simulations were prepared to determine which areas of the generation facility and mine would be visible from Little Mountain with vegetation removed, which is the worst case scenario.

Photographs were also taken from several perimeter highway locations on May 14, 1997, and two were selected for further study. The first is a view southwest from a mobile home along Highway 9, just north of the TVA transmission line. The second is a view northeast from Highway 415, just north of the Lebanon Road intersection.

Using a combination of ArcInfo, Autocad, Landcadd, Photoshop, and 3-D Studio, digital plans of the mining schedule, generation facility structures, and elevation data, were used to create a three-dimensional computer model of the project during operation. Four viewpoints were set in the computer model, two from Little Mountain, one from the Highway 9 location, and one from the Highway 415 location.

At Little Mountain, one viewpoint was set at the east facing overlook and the other approximately 200 feet from the overlook, near the NPS water tank. Reference points were identified in the photographs where actual locations were known. This included a water tower on Highway 15 visible in the photograph, along with several prominent ridge line areas located on a USGS topographic quadrangle. Using 3-D Studio, the computer model was adjusted to the perspective and scale of the photographs and then superimposed onto the photographs. This process realistically showed the visual impacts of the generation facility and mining operations from the overlook areas with vegetation removed. However, the chance of actually seeing these views is very low since the NPS is committed to protecting existing overlook vegetation and discourages visitor access to the water tank area. The view from near the water tank looks across a former clear-cut area, and will be blocked in three to five years by pine growth in the immediate foreground. Because of these factors the water tank viewpoint analysis and the simulated view studies are not included in the EIS.

The computer model was also adjusted to the perspective and scale of the photographs from the two highway locations. It was superimposed on each of them to look at the generation facility, as seen from the two viewpoints.

D-7.2 Night Sky Analysis-Walker's Law (Clanton 1997)

Walker's Law (International Dark-Sky Association, no date), used to develop the comparative tables in Chapter 4, is a correlation developed to help estimate the increase in sky brightness at an observatory due to a nearby city. Walker's Law is written:

$$I = 0.01 * (\text{Population}) * (r)^{-2.5}$$

where I is the expected percent increase in sky brightness, "Population" is the population of the city, and "r" is the distance, in km, between the observatory and the center of the city. The formula has been found to be most accurate for cities for which the number of lumens per person is between 500 and 1000, and for distances less than 30 km. To achieve good results from this formula, it was rewritten to read as follows (with the calculation for the mine is used as an example):

$$I_{minimum} = 0.01 * (\text{minimum total lumens in mine}/1000) * (r)^{-2.5}/1.71$$

and

$$I_{maximum} = 0.01 * (\text{maximum total lumens in mine}/500) * (r)^{-2.5}.$$

where "r" is the distance, in km, from the viewing site to the center of the mine (in this example). Walkers Law predicts sky brightness increases when looking in a direction 45° down from the zenith toward the source of the light pollution. However, the brightness of the zenith is less than the brightness at 45° from the zenith. $I_{minimum}$ was divided by 1.71 to correct for the brightness decrease between 45° from the zenith and the zenith. The number 1.71 was derived from measurements taken by Jim Hill from the Rainwater Observatory. For shielded "dark sky" lighting, the effective number of total lumens is reduced by 35%.

Appendix D-7.3 Night Sky Analysis-Project Lighting Needs and Brightness (Clanton 1997) Estimated

The following three work sheets show the estimated lighting needs for the mine, generation facility and EcoPlex. The next two work sheets show the tabulated brightness increases in the construction and operation phases as seen from the observatory, with typical and shielded lighting. The last two work sheets show the tabulated brightness increases as seen from Jeff Busby developed area.

Table D-7.1 Estimation of Mine Lighting Needs (Clanton Engineering, Inc. (RSH))

Lighted Object	Fixture Type	Minimum Lumens per Fixture	Maximum Lumens per Fixture	Minimum Number of Light Fixtures per Lighted Object	Maximum Number of Light Fixtures per Lighted Object	Minimum Number of Lighted Objects in Mine	Maximum Number of Lighted Objects in Mine	Minimum Number of Lumens in Mine	Maximum Number of Lumens in Mine
Light Plant	1000W HPS Flood	120,700	130,000	2	6	5	10	1,207,000	7,800,000
Walking Dragline	1000W MH Flood	80,700	101,600	25	30	1	1	2,017,500	3,048,000
Track-type Tractor	65W TH Headlamp	1,105	1,495	6	6	6	10	39,780	89,700
Scraper	65W TH Headlamp	1,105	1,495	4	6	3	5	13,260	44,850
Mining Shovel	60W TH Headlamp	2,000	2,000	8	10	1	1	16,000	20,000
End Dump Truck	65W TH Headlamp	1,105	1,495	8	8	5	6	44,200	71,760
Wheel Bulldozer	60W TH Headlamp	2,000	2,000	4	6	1	1	8,000	12,000
Hydraulic Excavator	65W TH Headlamp	1,105	1,495	6	8	1	1	6,630	11,960
Front End Loader	60W TH Headlamp	2,000	2,000	4	8	2	2	16,000	32,000
Motor Grader	65W TH Headlamp	1,105	1,495	6	6	1	2	6,630	17,940
Backhoe Loader	55W TH Headlamp	1,450	1,450	4	8	1	1	5,800	11,600
Crawler Crane	60W TH Headlamp	2,000	2,000	6	6	1	1	12,000	12,000
Compactor	60W TH Headlamp	2,000	2,000	4	6	1	2	8,000	24,000
Water Truck	65W TH Headlamp	1,105	1,495	4	4	2	2	8,840	11,960
Rear Dump Truck	60W TH Headlamp	2,000	2,000	2	2	1	2	4,000	8,000
Various Trucks	60W TH Headlamp	2,000	2,000	2	2	5	10	20,000	40,000
Various Vehicles	60W TH Headlamp	2,000	2,000	2	2	7	14	28,000	56,000
Coal Handling Area	1000W HPS Flood	120,700	130,000	1	2	1	1	120,700	260,000
Stockpile	1000W HPS Flood	120,700	130,000	6	8	1	1	724,200	1,040,000
Bucket Shed	150W HPS Wall-Pack	13,800	16,000	1	2	1	1	13,800	32,000
Ready Line/Wash Pad	1000W HPS Flood	120,700	130,000	1	2	1	1	120,700	260,000
Tank Farm	1000W HPS Flood	120,700	130,000	1	1	1	1	120,700	130,000
Office Building	150W HPS Wall-Pack	13,800	16,000	7	7	1	1	96,600	112,000
Office Parking Lot	1000W HPS Flood	120,700	130,000	2	4	1	1	241,400	520,000
Shop Building	150W HPS Wall-Pack	13,800	16,000	7	7	1	1	96,600	112,000
							TOTALS:	4,996,340	13,777,770

Table D-7.2 Estimation of Generation Facility Lighting Needs (Clanton Engineering, Inc. (RSH))

Lighted Object	Fixture Type	Minimum Lumens per Fixture	Maximum Lumens per Fixture	Minimum Number of Light Fixtures per Lighted Object	Maximum Number of Light Fixtures per Lighted Object	Minimum Number of Lighted Objects in Plant	Maximum Number of Lighted Objects in Plant	Minimum Number of Lumens in Plant	Maximum Number of Lumens in Plant
Various Trucks	60W TH Headlamp	2,000	2,000	2	4	5	10	20,000	80,000
Various Vehicles	60W TH Headlamp	2,000	2,000	2	4	5	10	20,000	80,000
Turbine Building	150W HID	8,650	16,000	20	30	1	1	173,000	480,000
Boiler Building	70W HID Flood	3,900	6,300	125	350	1	1	487,500	2,205,000
Baghouse #1	150W HID	8,650	16,000	8	10	1	1	69,200	160,000
Baghouse #2	150W HID	8,650	16,000	8	10	1	1	69,200	160,000
Stack	150W HID	8,650	16,000	10	15	1	1	86,500	240,000
Admin. & Warehouse	150W HID	8,650	16,000	15	20	1	1	129,750	320,000
Admin. Building Parking Lot	400W HID Flood	20,500	50,000	4	8	1	1	82,000	400,000
Facility Roads	400W HID Flood	20,500	50,000	8	10	1	1	164,000	500,000
Transformer Yard	400W HID Flood	20,500	50,000	5	8	1	1	102,500	400,000
Substation	150W HID	8,650	16,000		4	1	1	-	64,000
Water Tank	150W HID	8,650	16,000	0	2	1	1	-	32,000
Cooling Tower	150W HID	8,650	16,000	30	35	1	1	259,500	560,000
Emergency Truck Dump	400W HID Flood	20,500	50,000	1	2	1	1	20,500	100,000
Lignite Storage Barn	150W HID	8,650	16,000	30	35	1	1	259,500	560,000
Crusher House	150W HID	8,650	16,000	5	10	1	1	43,250	160,000
Limestone Storage Silo	70W HID Flood	3,900	6,300	4	6	1	1	15,600	37,800
Wood Waste Storage Pile	400W HID	8,650	16,000	0	3	1	1	-	48,000
Ash Silo	150W HID	8,650	16,000	0	1	1	1	-	16,000
Limestone Unloading	400W HID	8,650	16,000	0	2	1	1	-	32,000
Wood Waste Unloading	400W HID	8,650	16,000	0	2	1	1	-	32,000
Overland Conveyor	150W HID	8,650	16,000	50	100	1	1	432,500	1,600,000
Elevated Conveyor	150W HID	8,650	16,000	80	160	1	1	692,000	2,560,000

Table D-7.2 Estimation of Generation Facility Lighting Needs (Clanton Engineering, Inc. (RSH))

Lighted Object	Fixture Type	Minimum Lumens per Fixture	Maximum Lumens per Fixture	Minimum Number of Light Fixtures per Lighted Object	Maximum Number of Light Fixtures per Lighted Object	Minimum Number of Lighted Objects in Plant	Maximum Number of Lighted Objects in Plant	Minimum Number of Lumens in Plant	Maximum Number of Lumens in Plant
Mine Haul Road	None	-	-	0	0	1	1	-	-
Water Treatment	150W HID	8,650	16,000	15	20	1	1	129,750	320,000
Waste Water Treatment	150W HID	8,650	16,000	10	15	1	1	86,500	240,000
Raw Water Storage Pond	None	-	-	0	0	1	1	-	-
Construction Office Area	150W HID	8,650	16,000	15	20	1	1	129,750	320,000
Construction Parking	400W HID Flood	20,500	50,000	30	35	1	1	615,000	1,750,000
Construction Entrance Road	None	-	-	0	0	1	1	-	-
Construction Laydown	400W HID Flood	20,500	50,000	5	10	1	1	102,500	500,000
Facility Entrance Road	None	-	-	0	0	1	1	-	-
Well	150W HID	8,650	16,000	0	0	3	3	-	-
Plant Area Stormwater Pond	None	-	-	0	0	1	1	-	-
Ash Disposal Area Stormwater Pond	None	-	-	0	0	1	1	-	-
							TOTALS:	4,190,000	13,956,800

Table D-7.3 Estimation of EcoPlex Lighting Needs (Clanton Engineering, Inc. (RSH))			
Tenant	Percent of Plant Lighting	Minimum Lumens for Tenant	Maximum Lumens for Tenant
Hydroponic Greenhouses	60%	2,514,000	8,374,080
Conventional Greenhouses	50%	2,095,000	6,978,400
Aquaculture	90%	3,771,000	12,561,120
Agricultural Fiberboard	100%	4,190,000	13,956,800
	ECOPLEX TOTALS:	12,570,000	41,870,400

Table D-7.4 Estimates of Sky Brightness Increases

Due to: ***Mine, Generation Facility, and EcoPlex***
Viewed from: ***Rainwater Observatory in French Camp, MS***
Lighting Type: ***Typical (Unshielded)***

Area	Min Lumens	Max Lumens	Min "n"	Max "n"	Distance (km)	Imin: Minimum Percent Brightness Increase	Imax: Maximum Percent Brightness Increase	Min Increase as Factor	Max Increase as Factor
Mine with Typical Lighting	4,996,340	13,777,770	4,996	27,556	19.3	1.79%	16.84%	1.02	1.17
Mine Construction with Typical Lighting	25,950	520,000	26	1,040	20.1	0.01%	0.57%	1.00	1.01
Facility with Typical Lighting	4,190,000	13,956,800	4,190	27,914	20.1	1.35%	15.41%	1.01	1.15
Facility Construction with Typical Lighting	7,000,000	10,000,000	7,000	20,000	20.1	2.26%	11.04%	1.02	1.11
EcoPlex with Typical Lighting	12,570,000	41,870,400	12,570	83,741	20.1	4.06%	46.23%	1.04	1.46
EcoPlex Construction with Typical Lighting	37,710,000	125,611,200	37,710	251,222	20.1	12.18%	138.70%	1.12	2.39
All Operation Typical	21,756,340	69,604,970	21,756	139,210	19.8	7.26%	79.47%	1.07	1.79
All Construction Typical	44,735,950	136,131,200	44,736	272,262	20.1	14.44%	150.31%	1.14	2.50

Min "n" = (Min Lumens/1000) and Max "n" = (Max Lumens/500)

Observatory is 12 miles (19.3 km) from the mine and 12.5 miles (20.1 km) from the mine construction site.
Observatory is 12.5 miles (20.1 km) from the facility.
Observatory is 12.5 miles (20.1 km) from the EcoPlex.

Table D-7.5 Estimates of Sky Brightness Increases

Due to: ***Mine, Generation Facility, and EcoPlex***
Viewed from: ***Rainwater Observatory in French Camp, MS***
Lighting Type: ***Dark Sky (Shielded)***

Area	Min Lumens	Max Lumens	Min "n"	Max "n"	Distance (km)	Imin: Minimum Percent Brightness Increase	Imax: Maximum Percent Brightness Increase	Min Increase as Factor	Max Increase as Factor
Mine with Shielded Lighting	3,247,621	8,955,551	3,248	17,911	19.3	1.16%	10.9%	1.01	1.11
Mine Construction with Shielded Lighting	16,868	338,000	17	676	20.1	0.01%	0.4%	1.00	1.00
Facility with Shielded Lighting	2,723,500	9,071,920	2,724	18,144	20.1	0.88%	10.0%	1.01	1.10
Facility Construction with Shielded Lighting	4,550,000	6,500,000	4,550	13,000	20.1	1.47%	7.2%	1.01	1.07
EcoPlex with Shielded Lighting	8,170,500	27,215,760	8,171	54,432	20.1	2.64%	30.1%	1.03	1.30
EcoPlex Construction with Shielded Lighting	24,511,500	81,647,280	24,512	163,295	20.1	7.91%	90.2%	1.08	1.90
All Operation Shielded	14,141,621	45,243,231	14,142	90,486	19.8	4.72%	51.7%	1.05	1.52
All Construction Shielded	29,078,368	88,485,280	29,078	176,971	20.1	9.39%	97.7%	1.09	1.98

Min "n" = (Min Lumens/1000) and Max "n" = (Max Lumens/500)

Observatory is 12 miles (19.3 km) from the mine and 12.5 miles (20.1 km) from the mine construction site.
Observatory is 12.5 miles (20.1 km) from the facility.
Observatory is 12.5 miles (20.1 km) from the EcoPlex.

Table D-7.6 Estimates of Sky Brightness Increases

Due to: ***Mine and Generation Facility Only***
Viewed from: ***Rainwater Observatory in French Camp, MS***
Lighting Type: ***Typical (Unshielded)***

Area	Min Lumens	Max Lumens	Min "n"	Max "n"	Distance (km)	Imin: Minimum Percent Brightness Increase	Imax: Maximum Percent Brightness Increase	Min Increase as Factor	Max Increase as Factor
Mine with Typical Lighting	4,996,340	13,777,770	4,996	27,556	19.3	1.79%	16.84%	1.02	1.17
Mine Construction with Typical Lighting	25,950	520,000	26	1,040	20.1	0.01%	0.57%	1.00	1.01
Facility with Typical Lighting	4,190,000	13,956,800	4,190	27,914	20.1	1.35%	15.41%	1.01	1.15
Facility Construction with Typical Lighting	7,000,000	10,000,000	7,000	20,000	20.1	2.26%	11.04%	1.02	1.11
All Operation Typical	9,186,340	27,734,570	9,186	55,469	19.7	3.12%	32.20%	1.03	1.32
All Construction Typical	7,025,950	10,520,000	7,026	21,040	20.1	2.27%	11.62%	1.02	1.12

Min "n" = (Min Lumens/1000) and Max "n" = (Max Lumens/500)

Observatory is 12 miles (19.3 km) from the mine and 12.5 miles (20.1 km) from the mine construction site.
Observatory is 12.5 miles (20.1 km) from the facility.
Observatory is 12.5 miles (20.1 km) from the EcoPlex.

Table D-7.7 Estimates of Sky Brightness Increases

Due to: ***Mine and Generation Facility Only***
Viewed from: ***Rainwater Observatory in French Camp, MS***
Lighting Type: ***Dark Sky (Shielded)***

Area	Min Lumens	Max Lumens	Min "n"	Max "n"	Distance (km)	Imin: Minimum Percent Brightness Increase	Imax: Maximum Percent Brightness Increase	Min Increase as Factor	Max Increase as Factor
Mine with Shielded Lighting	3,247,621	8,955,551	3,248	17,911	19.3	1.16%	10.9%	1.01	1.11
Mine Construction with Shielded Lighting	16,868	338,000	17	676	20.1	0.01%	0.4%	1.00	1.00
Facility with Shielded Lighting	2,723,500	9,071,920	2,724	18,144	20.1	0.88%	10.0%	1.01	1.10
Facility Construction with Shielded Lighting	4,550,000	6,500,000	4,550	13,000	20.1	1.47%	7.2%	1.01	1.07
All Operation Shielded	5,971,121	18,027,471	5,971	36,055	19.7	2.03%	20.9%	1.02	1.21
All Construction Shielded	4,566,868	6,838,000	4,567	13,676	20.1	1.47%	7.6%	1.01	1.08

Min "n" = (Min Lumens/1000) and Max "n" = (Max Lumens/500)

Observatory is 12 miles (19.3 km) from the mine and 12.5 miles (20.1 km) from the mine construction site.
Observatory is 12.5 miles (20.1 km) from the facility.
Observatory is 12.5 miles (20.1 km) from the EcoPlex.

Table D-7.8 Estimates of Sky Brightness Increases

Due to: ***Mine, Generation Facility, and EcoPlex***
Viewed from: ***Jeff Busby developed area***
Lighting Type: ***Typical (Unshielded)***

Area	Min Lumens	Max Lumens	Min "n"	Max "n"	Distance (km)	Imin: Minimum Percent Brightness Increase	Imax: Maximum Percent Brightness Increase	Min Increase as Factor	Max Increase as Factor
Mine with Typical Lighting	4,996,340	13,777,770	4,996	27,556	3.2	159.51%	1504.30%	2.60	16.04
Mine Construction with Typical Lighting	25,950	520,000	26	1,040	5.6	0.20%	14.01%	1.00	1.14
Facility with Typical Lighting	4,190,000	13,956,800	4,190	27,914	6.4	23.65%	269.38%	1.24	3.69
Facility Construction with Typical Lighting	7,00,000	10,000,000	7,000	20,000	6.4	39.50%	193.01%	1.40	2.93
EcoPlex with Typical Lighting	12,570,000	41,870,400	12,570	83,741	8.0	40.61%	462.61%	1.41	5.63
EcoPlex Construction with Typical Lighting	37,710,000	125,611,200	37,710	251,222	8.0	121.82%	1387.82%	2.22	14.88
All Operation Typical	21,756,340	69,604,970	21,756	139,210	5.9	152.62%	1669.90%	2.53	17.70
All Construction Typical	44,735,950	136,131,200	44,736	272,262	6.7	227.98%	2372.55%	3.28	24.73

Min "n" = (Min Lumens/1000) and Max "n" = (Max Lumens/500)
Jeff Busby developed area is 2 miles (3.2 km) from the mine and 3.5 miles (5.6 km) from the mine construction site.
Jeff Busby developed area is 4 miles (6.4 km) from the facility.
Jeff Busby developed area is 5 miles (8.0 km) from the EcoPlex.

Table D-7.9 Estimates Of Sky Brightness Increases

Due to: ***Mine, Generation Facility, and EcoPlex***
Viewed from: ***Jeff Busby developed area***
Lighting Type: ***Dark Sky (Shielded)***

Area	Min Lumens	Max Lumens	Min "n"	Max "n"	Distance (km)	Imin: Minimum Percent Brightness Increase	Imax: Maximum Percent Brightness Increase	Min Increase as Factor	Max Increase as Factor
Mine with Shielded Lighting	3,247,621	8,955,551	3,248	17,911	3.2	103.68%	977.79%	2.04	10.78
Mine Construction with Shielded Lighting	16,868	338,000	17	676	5.6	0.13%	9.11%	1.00	1.09
Facility with Shielded Lighting	2,723,500	9,071,920	2,724	18,144	6.4	15.37%	175.10%	1.15	2.75
Facility Construction with Shielded Lighting	4,550,000	6,500,000	4,550	13,000	6.4	25.68%	125.46%	1.26	2.25
EcoPlex with Shielded Lighting	8,170,500	27,215,760	8,171	54,432	8.0	26.40%	300.69%	1.26	4.01
EcoPlex Construction with Shielded Lighting	24,511,500	81,647,280	24,512	163,295	8.0	79.19%	902.08%	1.79	10.02
All Operation Shielded	14,141,621	45,243,231	14,142	90,486	5.9	99.20%	1085.44%	1.99	11.85
All Construction Shielded	29,078,368	88,485,280	29,078	176,971	6.7	148.18%	1542.16%	2.48	16.42

Min "n" = (Min Lumens/1000) and Max "n" = (Max Lumens/500)
Jeff Busby developed area is 2 miles (3.2 km) from the mine and 3.5 miles (5.6 km) from the mine construction site.
Jeff Busby developed area is 4 miles (6.4 km) from the facility.
Jeff Busby developed area is 5 miles (8.0 km) from the EcoPlex.

Table D-7.10 Estimates of Sky Brightness Increases

Due to: ***Mine and Generation Facility Only***
Viewed from: ***Jeff Busby developed area***
Lighting Type: ***Typical (Unshielded)***

Area	Min Lumens	Max Lumens	Min "n"	Max "n"	Distance (km)	Imin: Minimum Percent Brightness Increase	Imax: Maximum Percent Brightness Increase	Min Increase as Factor	Max Increase as Factor
Mine with Typical Lighting	4,996,340	13,777,770	4,996	27,556	3.2	159.51%	1504.30%	2.60	16.04
Mine Construction with Typical Lighting	25,950	520,000	26	1,040	5.6	0.20%	14.01%	1.00	1.14
Facility with Typical Lighting	4,190,000	13,956,800	4,190	27,914	6.4	23.65%	269.38%	1.24	3.69
Facility Construction with Typical Lighting	7,000,000	10,000,000	7,000	20,000	6.4	39.50%	193.01%	1.40	2.93
All Operation Typical	9,186,340	27,734,570	9,186	55,469	4.8	106.42%	1098.88%	2.06	11.99
All Construction Typical	7,025,950	10,520,000	7,026	21,040	6.0	46.59%	238.60%	1.47	3.39

Min "n" = (Min Lumens/1000) and Max "n" = (Max Lumens/500)
Jeff Busby developed area is 2 miles (3.2 km) from the mine and 3.5 miles (5.6 km) from the mine construction site.
Jeff Busby developed area is 4 miles (6.4 km) from the facility.
Jeff Busby developed area is 5 miles (8.0 km) from the EcoPlex.

Table D-7.11 Estimates of Sky Brightness Increases

Due to: ***Mine and Generation Facility Only***
Viewed from: ***Jeff Busby developed area***
Lighting Type: ***Dark Sky (Shielded)***

Area	Min Lumens	Max Lumens	Min "n"	Max "n"	Distance (km)	Imin: Minimum Percent Brightness Increase	Imax: Maximum Percent Brightness Increase	Min Increase as Factor	Max Increase as Factor
Mine with Shielded Lighting	3,247,621	8,955,551	3,248	17,911	3.2	103.68%	977.79%	2.04	10.78
Mine Construction with Shielded Lighting	16,868	338,000	17	676	5.6	0.13%	9.11%	1.00	1.09
Facility with Shielded Lighting	2,723,500	9,071,920	2,724	18,144	6.4	15.37%	175.10%	1.15	2.75
Facility Construction with Shielded Lighting	4,550,000	6,500,000	4,550	13,000	6.4	25.68%	125.46%	1.26	2.25
All Operation Shielded	5,971,121	18,027,471	5,971	36,055	4.8	69.18%	714.27%	1.69	8.14
All Construction Shielded	4,566,868	6,838,000	4,567	13,676	6.0	30.29%	155.09%	1.30	2.55

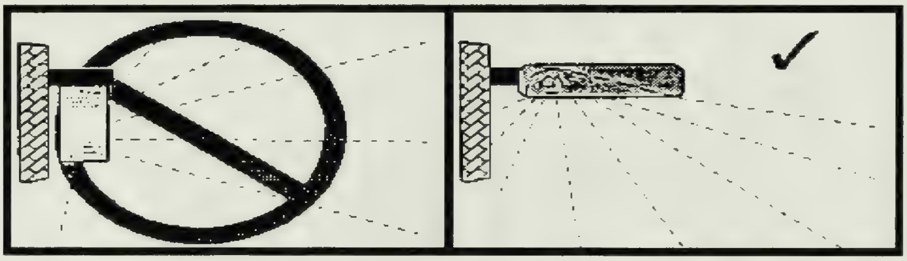
Min "n" = (Min Lumens/1000) and Max "n" = (Max Lumens/500)
Jeff Busby developed area is 2 miles (3.2 km) from the mine and 3.5 miles (5.6 km) from the mine construction site.
Jeff Busby developed area is 4 miles (6.4 km) from the facility.
Jeff Busby developed area is 5 miles (8.0 km) from the EcoPlex.

D-7.4 Visual Resources - Night Sky-Increased Brightness Mitigation Guidelines (Clanton 1997)

These guidelines were developed to help mitigate increased night-sky brightness resulting from construction and operation of the mine and generation facility.

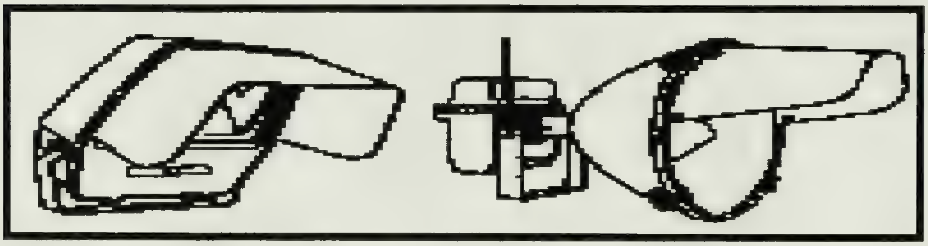
The mitigation process consists of several steps which include evaluating the need for various night time activities, determining the appropriate lighting level and frequency for these activities, then implementing appropriate "dark sky" lighting techniques. These techniques are described below.

All lights used (including headlights and pole-mounted, equipment-mounted or structure-mounted floodlights) should be fully shielded or should have internal low-glare optics, such that no light is emitted from the fixture at angles above the horizontal. Upward light transmission is eliminated with properly shielded fixtures. For construction, this may require temporarily retrofitting headlights, floodlights and other fixtures with external visors and side-shields. Shielded LPS security lighting should be used during the construction phase of the mine.

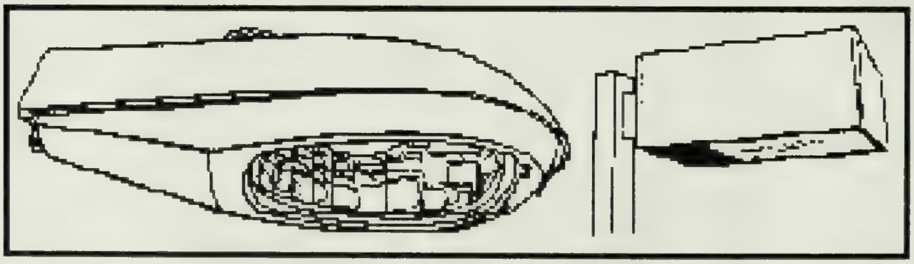


Emission above the horizontal

No emission above the horizontal



Shielded Floodlights



Fixtures with Low-Glare Optics

Graphics are courtesy of the International Dark-Sky Association and the Illuminating Engineering Society of North America.

Area lighting and parking lot poles should be no taller than 40 feet, unless they are being used to light objects that are taller than 40 feet. In such cases pole heights should be minimized.

Low-pressure sodium (LPS) lighting should be used to provide exterior lighting for construction and operation of project facilities, wherever color rendering is not necessary. LPS is the most efficient readily-available light source, and because it is monochromatic, it can easily be filtered out by telescopes. However, the pure yellow-orange light does not provide color differentiation or good depth perception. LPS fixtures should be used for floodlighting wherever color recognition and depth perception are not critical, such as parking lots, stockpiles, conveyors, and building entrances and facades. Low levels of shielded whiter light from compact fluorescent sources, approximately 10% of the total illuminance, can be mixed with LPS light for improved color recognition, if necessary. LPS lighting should not be used on the dragline or other locations where depth perception is critical or where fixtures must be rated for hazardous applications.

Whenever possible, lighting should be aimed away from the observatory. No fixtures should be aimed at angles above the horizontal, or at angles at which the shielding is not wholly effective. Trucks coming out of the mine pit should travel in a direction facing away from the observatory. Current design for the mine ramp provides a vertical curve radius that is always greater than the truck-to-ground distance for the lights, so the lights would be continuously aimed at the ground.

All exterior lighting should be turned off when it is not needed. Lighting on the dragline boom should be switched such that multiple levels are available. General conveyor lighting should be controlled in sections and turned on only when needed. Manually switched task lighting should be used in the vicinity of the boilers for reading digital readout panels and gauges. Centralized lighting control should be provided from the plant control room, and operators must be instructed as to which lights should be turned off at night.

Mine and generation facility employees must be made aware of the locations of both Rainwater Observatory and Jeff Busby developed area campground, the impacts on these facilities, and what they should do to minimize these impacts. Project management should initiate periodic checks to ensure that lighting is properly shielded, aimed, and controlled.

For the plant stack and any other applicable structure, a dual lighting system of aviation warning devices in accordance with FAA Advisory Circular AC 70/7460-1J(1/1/96) should be used. Repetitive flashes in the night sky from strobes would interfere with telescope use and photography at the observatory. Use of medium-intensity strobes during the day and only steady red lights at night will eliminate night flash.

Bed Ash (Bottom Ash) – Material containing heavier ash (noncombustible component of lignite or other fuels) that settles in the bottom of the boiler rather than being carried with flue gas.

Bench – A leveled area near the pit that provides a safe location for the equipment to operate.

Benthic Invertebrates – An animal lacking a spinal column and living on lake and stream bottoms.

Best Management Practice (BMP) – A practice, or combination of practices, that is determined to be the most effective, practical means of preventing or reducing non-point source pollution to a level compatible with maintaining water quality.

Biodiversity – The diversity of life in all its forms and all its level of organization.

Biomass – The amount of living matter, as in a unit area or volume of habitat.

Blasting – Use of explosives to loosen consolidated overburden materials or lignite.

Boiler – A pressurized system in which water is vaporized to steam, the desired end product, by heat transferred from a source of higher temperature, usually the products of combustion from burning fuels.

Boiler Slag – Ash that has been melted during the combustion process and then solidified as it is removed from the boiler.

Bond Release – The final release of reclaimed land from the five-year extended responsibility period after all reclamation performance standards have been met.

Carbon Dioxide (CO_2) – A colorless, odorless, nonpoisonous gas that results from fossil fuel combustion and is normally a part of the ambient air.

Carbon Monoxide (CO) – A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion.

Cation – A positively charged ion.

CFB Combustion Plant – A generating station which produces electricity by utilizing a Circulating Fluidized Bed, in which lignite and limestone are both injected in the combustion chamber, where they are burned in a "bed" held in a fluid state by upward jets of hot air. The calcium in the limestone combines with suflur gases emitted by the burning lignite, resulting in an ash that contains the sulfur compounds, resulting in the elimination of most SO_2 emissions without the need for wet flue-gas scrubbers.

Class I Areas – National parks and wilderness areas designated by the Prevention of Significant Deterioration section of the Clean Air Act amendments. These amendments and the implementing regulations provide special protection to air quality and air quality related values (AQRV) in such areas. Only very slight deterioration of air quality is allowed in Class I areas.

Class II Areas – Most of the country not designated as Class I is designated as Class II. Class II areas are generally cleaner than air quality standards, and moderate increases in new pollution are allowed after a regulatory mandated impacts review.

Cogeneration – The sequential production of electricity and useful thermal energy (generally steam or hot water) from a single fuel source.

Cogenerators – An entity which produces cogeneration.

Combustion Turbine – A gas turbine that burns natural gas, fuel oil, or other similar fuels and drives a turbine and generator to produce electricity, and is typically used as the primary generator of electricity in a combined cycle installation.

Conductivity – The ability to carry an electrical charge in ions. The conductivity of aqueous solutions is increased by dissolved salts, and thus is a measure of the amount of ionized salts in solution.

Contiguous – Adjacent or touching.

Continuous Miner – An excavating machine, which utilizes a rotating drum equipped with picks to fracture and excavate material in a continuous fashion.

Convection – The transfer of heat by automatic circulation of a liquid at a nonuniform temperature.

Conveyor System – Method used to transport material in a continuous fashion, consisting of a drive, belt, pulleys, and conveyor stands. Material is placed on the belt and is moved by rotating the belt over pulleys.

Cooling Tower Drift – The dispersion and deposition of wet or dry aerosols emitted from natural or mechanical draft cooling towers.

Criteria – Standards on which a judgment or decision may be based.

Croplands – Lands used for growing agricultural crops such as soybeans and corn.

Cumulative Impact – The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Dragline – An electric-powered excavating machine used for digging or removal of overburden with a large capacity bucket that is lowered and raised by dragging in, paying out, hoisting, and lowering the wire rope attached to the bucket.

Deciduous – Shedding leaves at a certain season.

Demand-Side Management – Activities which influence electricity use on the customer's side of the meter.

Disturbed Area – Any area where vegetation, topsoil, or overburden is removed or upon which spoil is placed.

Diversions – The amount of water taken from a stream, spring, or well by channel, embankment, or other man-made structure constructed for the purpose of diverting water from one area to another.

Ecosystem – A community and its environment treated together as a functional system of complementary relationships involving the transfer and circulation of energy and matter.

Effects – The consequences or results of an action; synonymous with impacts. Includes direct effects caused by an action that occur at the same time and place, and indirect effects caused by an action that are later in time or further removed in distance but still reasonably foreseeable. Potential effects can be adverse, beneficial, cumulative, irretrievable, irreversible, long-term, or short-term.

Effluent – Wastewater, treated or untreated, that flows out of a treatment plant, sewer, or industrial outfall; generally refer to discharges into surface waters.

Electric and Magnetic Fields (EMF) – Two types of energy fields which are emitted from any device that generates, transmits, or uses electricity.

Electrostatic Precipitators – Devices used to remove particles from flue gas whereby electrically charged particles migrate and adhere to a grounded surface.

Emergent – Erect, rooted herbaceous plants, such as cattails and bulrush, which dominate wetlands.

Emission – A material discharged into the atmosphere from a source operation or activity.

Endangered Species – Any species in danger of extinction throughout all or a significant portion of its range or territory.

Erosion – The process by which particles of soils or other material are removed and transported by water, wind, and/or gravity to some other area.

Evaporation – A physical process by which a liquid is transformed into a gaseous state.

Fecal Coliforms – A large and varied group of bacteria flourishing in the intestines and feces of warm-blooded animals, including man. Large amounts of fecal bacteria in water indicate sewage, feedlot, or other animal waste pollution.

Floodplain – Level land that may be submerged by floodwaters; or a plain built up by stream depositions, subject to flooding.

Flue gas – Gaseous combustion products from a furnace or boiler.

Fluvial – Relating to, or produced by stream or river action.

Fly Ash – The small ash particles that are carried out of a combustor with the flue gas.

Fossil Fuel – Coal, including lignite, oil, or natural gas, formed from vegetation and animals under high pressure and temperatures during a past geological age.

Fragipan Horizon – A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard and has a higher bulk density than the horizon or horizons above.

Fugitive Emissions – Air pollutant emissions that cannot be traced to a particular point source.

Generation Facility – Electrical power generating station.

Geographic – Belonging to or characteristic of a particular region.

Global Warming – The theory that certain gases such as carbon dioxide, methane, and chlorofluorocarbon in the earth's atmosphere effectively restrict radiation cooling, thus elevating the earth's ambient temperatures or creating a greenhouse effect.

Groundwater – Water within a geologic stratum that supplies wells and springs.

Habitat – The environment occupied by individuals of a particular species, population, or community.

Hazardous Air Pollutants (HAP) – Air pollutants that are not covered by ambient air quality standards but that present, or may present, a threat of adverse health or environmental effects. These include an initial list of 189 chemicals designated by Congress that is subject to revision by the EPA.

Hazardous Waste – A by-product of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appears on special Environmental Protection Agency lists.

Haze – Atmospheric moisture, dust, smoke, and vapor suspended to form a partly opaque condition.

Heavy Metals – Natural trace elements such as lead, mercury, cadmium, and nickel, that are leachable and potentially toxic.

Herbicide – Any substance or mixture of substances intended to prevent the growth of or destroy unwanted plants or vegetation.

Heterogeneity – The quality or state of consisting of dissimilar ingredients or constituents.

Highwall – The face of exposed overburden and lignite in an open cut of a surface mine.

Historic Site – A site that is more than 50 years old.

Hydrology – A science dealing with the properties, distribution, and circulation of water on the surface of the land, in the soil and the underlying rocks, and in the atmosphere.

Impacts – The consequences or results of an action; synonymous with effects.

Impoundment – A body of water confined by a dam, dike, floodgate, or other barrier.

Independent Power Producers – Any person or entity who owns or operates a new power production facility and sells the electricity to an established utility or other consumer.

Infiltration – To enter, permeate, or pass through a substance of area by gradual filtering.

Infrastructure – The underlying foundation of basic framework, as in a system or organization.

Integrated Resource Planning – A utility planning process that evaluates supply-side resources and demand-side resources on a level field to reliably meet the future energy needs of customers.

Irretrievable Commitments – Those that are lost for a period of time.

Irreversible Commitments – Those that cannot be reversed, except perhaps in the extreme long term.

Issue – An expressed concern regarding the scope and analyses included in an EIS.

Lacustrine – Living or growing in lakes; of or related to lakes.

Landfill – Waste disposal method where waste material is stockpiled until the landfill is full, at which time, the material is buried and reclaimed in accordance with the applicable regulations for that type of landfill.

Legume – A member of the plant family Fabaceae.

Lignite – A brownish-black coal in which the alteration of vegetal matter has proceeded farther than peat, but not so far as sub-bituminous coal. Also known as brown coal.

Lignite Seam – A distinct layer of lignite with the potential to be mined

Lithological – Pertaining to the study of rocks and rock formations.

Long-term – Occurring over or involving a relatively long period time.

Megawatts (MW) – The amount of power equal to 1,000 kW or 1,000,000 watts.

Meteorology – The science dealing with weather and weather conditions.

Mitigation – Efforts to lessen the severity or to reduce adverse impacts: including avoiding the impact altogether by not taking a certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action; repairing, rehabilitating or restoring the affected environment; reducing or eliminating the impact over time by preservation; and compensating for the impact by replacing or providing substitute resources or environments.

Monitoring – Periodic or continuous determination of the amount of substances present in the environment.

National Ambient Air Quality Standards (NAAQS) – Uniform, national air quality standards established by the Environmental Protection Agency that restrict ambient levels of certain pollutants to protect public health (primary standards) or public welfare (secondary standards). Standards have been set for ozone, carbon monoxide, particulates, sulfur dioxide, nitrogen dioxide, and lead.

Native Species – Species normally indigenous to an area; not introduced by man.

Nitrogen Oxides (NOx) – A product of combustion by mobile and stationary sources and a major contributor to the formation of ozone in the troposphere.

Nonattainment – An area that does not meet air quality standards set by the Clean Air Act for specified localities and time periods. Locations where pollutant concentrations are greater than the NAAQS.

Noncombustion Wastes – Wastes that are not derived directly from combustion of the lignite.

Nonpoint Sources – Pollution sources that are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet. The pollutants are generally carried off the land by stormwater runoff.

Notice of Intent – Notice that an environmental impact statement will be prepared and considered, and is published in the Federal Register as soon as practicable as an agency knows that an EIS is required for a proposed action.

Option Purchase Agreements – A proposal, in the form of call options, put options, or forward contracts, by marketers, brokers, and others in the electric industry to sell electricity. An agreement where the purchaser has an option to purchase an asset at a future date and at an agreed-to price.

Overburden – Overburden which has been exposed to oxygen, resulting in the oxidation (loss of electrons) of many minerals.

Overburden Spoil – Material which has been removed from the pit prior to excavation of the lignite and placed on the surface to be either backfilled into an adjacent pit or stockpiled for use in other mined-out areas.

Oxidized Overburden – Overburden which has been exposed to oxygen, resulting in the oxidation (loss of electrons) of many minerals.

Ozone – A form of oxygen found naturally in the stratosphere and that provides a protective layer for shielding the Earth from ultraviolet radiation.

Palustrine – Living or thriving in a marshy environment.

Particulates – Small particles of solid or liquid materials that, when suspended in the atmosphere, constitute an atmospheric pollutant.

Particulate Matter (PM) – Fine solid particles that remain individually dispersed.

$PM_{2.5}$: Particulate matter comprised of particles whose diameters are smaller than or equal to 2.5 micrometers in diameter.

PM_{10}: Particulate matter comprised of particles whose diameters are smaller than or equal to 10 micrometers in diameter.

Peaking Capacity – Capacity that is available for use and used to meet peak load, but usually designed to operate for relatively short periods of time.

Peak Demand – The maximum rate of electricity use, expressed in kW.

Peak Load – The maximum load experienced by an electric system over a given period of time.

Pedogenic – Having to do with soil horizons.

Permeability – A quality of having pores or openings through which liquids or gases are allowed to pass.

Piezometer – An instrument for measuring pressure or compressibility of a material subjected to hydrostatic pressure.

Point Sources – A stationary location or fixed facility from which pollutants are discharged or emitted. Also, any single identifiable source of pollution, for example, a pipe, ditch, or stack.

Postmining Land Use – The land use that is selected by the landowner for use after the mining and reclamation process has been completed.

Potentiometric – An ionic gradient; having electromotive force of difference of electrical potentials.

Plume – A flowing, often somewhat conical, trail of emissions from a continuous point source.

Prevention of Significant Deterioration – An Environmental Protection Agency program in which federal or state permits are required that are intended to restrict emissions for new or modified sources in places where air quality is already better than required to meet primary and secondary ambient air quality standards.

Prime Farmland – Land with the physical and chemical characteristics suitable for producing sustained high yields of food, feed, forage, fiber, and oilseed crops, and that is available for these uses.

Pulverized Coal – Crushed coal used to fuel a coal power plant. Currently the principal electric generation technology in the US

Qualitative – Analysis based on professional judgment of quality, generally lacking hard data.

Quantitative – Analysis based on hard data or numbers that can generally be repeated.

Radionuclides – Radioactive particles, which are characterized by the constitution of the nucleus and hence the energy content.

Reclamation – Restoration of land, water bodies, or other affected environmental resources to the original use, or equal to or better alternate use.

Reconstructed Soil – Selected overburden material, which consist of suitable materials, based on physical and chemical parameters analyzed during a comparison of the native soils and the oxidized portion of the overburden material, which would be selected to replace the native soils as a topsoil-substitute material.

Record of Decision – The concluding document of the NEPA process, as based on the conclusions of the EIS process, which states the agency's decision for the preferred alternative, along with its rationale for its selection, including the major environmental reasons.

Recycled – The process or reusing or reprocessing a material after its initial use.

Revegetation – The process of establishing new vegetative cover.

Riparian – Pertaining to, situated, or dwelling on the bank of a river or other body of water.

Rippers – Dozers that are fitted with single-shank ripper attachment to rip the lignite seams prior to extraction.

Riprap – Stones placed at the edge of a waterbody for bank stabilization, erosion control, and other purposes.

Runoff – The portion of precipitation falling on the land that flows over the surface, rather than soaking into the surface.

Scoping Meeting – An early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action.

Scrubber – A device that removes noxious gases from flue gases (such as sulfur dioxide) by using absorbents suspended in liquid solution.

Scrubber Sludge – The effluent from a scrubber used to remove SO_2 from flue gases, as calcium sulfate.

Scrub-Shrub – Woody vegetation less than 20 ft tall. Species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions.

Sediment – Material that has been eroded, transported, and deposited by erosional processes, typically wind, water, and/or glaciers.

Sedimentation – The process or action of depositing sediment.

Sediment Control – The planning and construction of facilities for prevention of excessive damage by water in flood stages.

Seedling – A young plant developing from a seed. In a commercial forestry context, a live tree less than 1.0 inch in diameter.

Short-term – Occurring over or involving a short period of time.

Significant – As used in an EIS, a measure of the severity of an impact, based on the setting, timing, and intensity of the impact.

Slagging – Ash that has been melted during the combustion process and then solidified as it is removed from the boiler.

Soil – A dynamic natural medium composed of mineral and organic materials in which plants grow.

Soil Amendments – Fertilizers and other materials added to soil to make it suitable for prescribed uses.

Sorbent – A substance that takes up and holds.

Spill Prevention Control and Countermeasure Plan – A plan that is implemented to protect navigable waters of the US from harmful quantities of petroleum discharges.

Spoil – Overburden material from the mined–out pit, which would be utilized to backfill an open pit, or otherwise be used to achieve original topography.

Stratification – The seasonal layering of water within a reservoir due to differences in temperature or chemical characteristics of the layers.

Streams – A continually, frequently, or infrequently flowing body of water that follows a defined course. The three classes of streams are:

Ephemeral: A channel that carries water only during and immediately following rainstorms.

Intermittent: A watercourse that flows in a well-defined channel during the wet seasons of the year, but not the entire year.

Perennial: A watercourse that flows throughout the year or nearly 90 percent of the time in a well-defined channel.

Subsidence – A sinking of a part of the surface topography.

Substation – An assemblage of equipment for the purposes of switching and/or changing or regulating the voltage of electricity.

Substrates – The base or material to which a plant is attached and from which it receives nutrients.

Sulfur Dioxide (SO_2) – A heavy, pungent, colorless, gaseous air pollutant formed primarily by the combustion of fossil-fuel plants.

Surface Water – Streams, rivers, ponds, lakes, and man-made reservoirs.

Threatened Species – Any species that is likely to become an endangered species within the foreseeable future.

Topography – The configuration of a surface including its relief and position of the natural and man-made features.

Topsoil – The upper native soil layer, usually consisting of the A and E horizons.

Topsoil Substitution – The use of suitable materials, based on physical and chemical parameters analyzed during a comparison with native soils, which have been selected to replace the native soils due to their capability to be equal to or greater than native soils in terms of productivity.

Transmissivity – The quality of transmitting groundwater through a geologic stratum or formation.

Turbidity – Defined as capacity of material suspended in water to scatter light. Highly turbid water is often called muddy; although all manner of suspended particles contribute to turbidity.

Turbine – A machine for directly converting the kinetic energy and/or thermal energy of a flowing fluid (air, hot gas, steam, or water) into useful rotational energy.

Understory – Saplings, shrubs, forbs, and other low-growing vegetation present in a forest.

Upconing – Vertical upward intrusion from lower water into a shallower groundwater zone caused by pressure reductions in the shallower groundwater zone, usually applies when water in the deeper zone is denser.

Upland – The higher parts of a region, not closely associated with streams or lakes.

Visual – Studies which access the scenic attractiveness, often describing the following adjectives of variety, unity, coherence, vividness, harmony, mystery, and uniqueness

Scenic Attractiveness: A measure of the scenic beauty of a landscape and of the responses it evokes in people. The measure helps identify landscapes that are important based on commonly held perceptions of the beauty of landforms, vegetation patterns, composition, surface water characteristics and land use patterns and cultural features.

Landform Patterns and Features: An assessment of the terrain such as gently rolling with wide valleys and small, slow flowing streams and rare rock outcroppings.

Vegetation Patterns: The mosaic of forest types or any visible vegetation pattern.

Volatile Organic Compounds (VOCs) – Any organic compound that participates in atmospheric photochemical reactions except for those designated by the EPA as having negligible reactivity.

Wastewater – A combination of liquid and water-carried wastes from residences, commercial buildings, and/or industrial facilities.

Watershed – A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.

Wetlands – An area where the soil experiences anaerobic conditions because of the inundation of water during a portion of any given year. Indicators of wetland include types of plants, soil characteristics, and hydrology of the area.

Worst Case – A situation in which the combination of factors that would produce the worst potential impact on the environment.

100-year Floodplain – Land that becomes or will become submerged by a flood that chances to occur every 100 years.

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